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ORIGINAL ARTICLES

ANCHORAGE PRINCIPLES IN MODERN ORTHODONTIA*

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THE forms of orthodontic appliances and the technic of their adaptation have quite materially changed in the last few years, the variety of forms ranging from the simplest to the most complex, from those utilizing inclination movement in whole or part to those embodying the principles of bodily movement of the teeth in whole or part; screw force has given place to spring force to a great extent; the lingual arch bids fair to displace the labial arch in many cases; the size of the expansion arch is diminutive in diameter, and the finger spring is often substituted for the silk or wire ligature; fixed appliances have in a sense become removable, and removable appliances have become fixed; and the gold and platinum or precious metal appliance has superseded that made of nickel silver.

Thus, the evolutionary cycle through which appliances have traveled is about complete, and the question arises as to whether all of these various changes in construction and method will stand the test of the principles of mechanics governing the application of forces to the teeth, especially the principles of anchorage.

Basic principles always endure, and in the application of the basic principles underlying anchorage to the best known and proved appliances of today, the answer to this question may be found, and the *principles emphasized*, which is the object of this paper.

To begin with, the appliances used for orthodontic treatment, being similar in principle to certain machines in use outside of the mouth, are necessarily amenable to the same laws or principles of mechanics which govern the action of applied forces in general.

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However, the limitations in the quality and quantity of the applied forces in the mouth, because of the danger of injury to the living elastic tissues involved, present a striking contrast to the application of similar forces in the field of general mechanics where physiologic considerations are unknown, and where force and resistance may be accurately measured. For example, in the field of applied mechanics in the arts, a force operating from an unstable resistance would not be considered practical, but, in the application of forces to the dental and alveolar tissues, the mechanical problems are not infrequently solved by the operation of a force from a more or less unstable base.

Stability in applied forces, or in the resistance to these forces in the mouth, can therefore never be regarded in the absolute, but it must be theoretically assumed in the mechanics of orthodontia in order that the nearest approach to absolute stability may be obtained through the application of the principles of mechanics governing force and resistance.

Hence, Newton's law, that *action and reaction are equal and opposite*, may be relatively applied to the action and reaction of force producing appliances upon the teeth, and from this principle of physics has been deduced the foundation principle in the mechanics of orthodontia, viz., that *the resistance in the anchor teeth, or basal resistance, must always be greater than the resistance at the points of delivery of the applied force*.

Stability in anchor teeth is the object of the application of this basic principle in physics, but as before stated, the comparatively unstable quality of the tissues in which the teeth are embedded makes it impossible to consider stability as an absolute factor in anchorage. Therefore, in the descriptions of some of the various forms of anchorage which follow, *stability of resistance* will be considered as *relative* only, though as near the *absolute* as the conditions will allow.

Furthermore, the *stability* of teeth used for anchorage varies with their power of resistance, which is determined by their use singly or in groups, by their size and location, the length and number of their roots, the period of development of the dental arches, as well as by the manner of application, the magnitude, and the direction of the applied force.

Thus, the whole foundation of the principles of anchorage is primarily based upon the utilization of sufficient passive and stable units of resistance in the anchor teeth to oppose and counterbalance or overcome the units of resistance in the teeth to be moved through the application of force, although this idea of anchorage has been modified to meet modern anchorage requirements in which the anchor teeth themselves take part in the tooth movement in conjunction with other teeth in the dental arches.

However, the resistance in the basal anchor teeth, including the choice of anchor teeth of larger size and more favorable location, the opposed resistance of teeth of less size and less favorable location, the reinforcement of the resistance of basal anchor teeth, the reciprocation of resistance of basal anchor teeth on opposite sides of the dental arch, and the adjustment of resistance values to secure proper control and direction of force, must be seen to be in each case, the *accurate selection of resistance units according to the requirements*, which is the essential factor in the following definition of anchorage:

ANCHORAGE consists in the selection of adequate and properly distributed resistance units for the control and direction of force applied to the teeth for dental arch development or for lesser tooth movements.

According to this definition the selection of resistance at the points of delivery of a force is as much anchorage as the selection of basal resistance in the anchor teeth, and this new interpretation of anchorage so extends its scope that the formerly undesigned points of application of the force may be properly designated and defined as they should be.

In the modern evolution of anchorage principles, it has become of paramount importance to thus distinguish between the resistance at the basal anchorage of the appliance and the opposed and often reenforced resistance at the other points of delivery of the force.

PRIMARY AND SECONDARY ANCHORAGE

In an attempt to more completely analyze and designate the various points of selected resistance in the dental arch for use as anchorage, I have first designated all points of attachment or delivery of force to the teeth as anchorage, as in the definition, the selected basal resistance being designated as *primary anchorage*

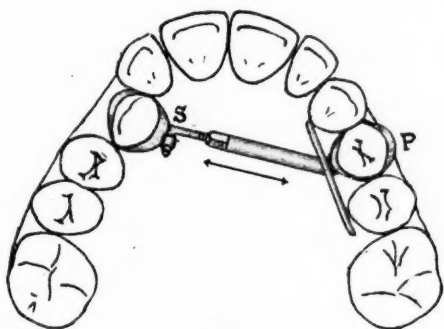


Fig. 1.

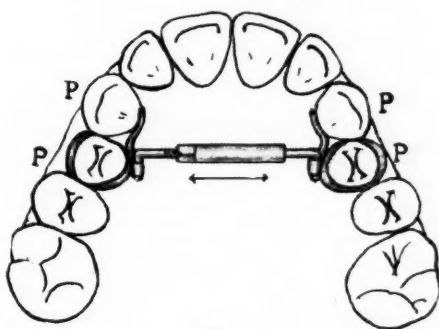


Fig. 2.

age, and the points of selected lesser resistance, opposed to the basal resistance at other points of delivery of the force, as *secondary anchorage*.

To simply illustrate these designations of primary and secondary anchorage, an appliance such as the jackscrew, delivering force in one direction only, will serve, although as an appliance for modern orthodontic treatment, it is out of date. In the more complex appliances of today, the application of force in the arc of a circle in innumerable different directions does not lend itself as readily to the elementary designations of primary and secondary anchorage, although it will be later shown.

Thus, in the attachment of the jackscrew across the dental arch, Fig. 1, although an appliance seldom used today, the *primary anchorage* is located in the bicuspid *P* and its reinforcements, the *secondary anchorage* being located at the point of delivery of the force in the cuspid *S*, where on account of the pivotal nature of the attachment, and the opposition of one tooth to three in the basal anchorage, a lesser resistance is established.

If the jackscrew were to be used directly across the dental arch, being attached on each side to bicuspids of equal resistance, even when reenforced, as in

Fig. 2, the resistance on one side would be equal to that of the other on the application of the force of the jackscrew, hence, there would be no points of *secondary anchorage*. In effect there will be established the reciprocation of the resistance of *two primary anchorages*. This same reciprocation of two *primary anchorages* may be observed at any location in the line of the arch where two or more teeth of equal resistance are opposed to each other in anchorage, as in the opposing of two centrals in an anchorage established for their equal mesial movement, Fig. 3.

However, if the resistance of two or more teeth along the line of the arch is opposed to one of lesser resistance, a *primary anchorage* would be established in the anchorage of greater resistance, and a *secondary anchorage* in the anchorage of lesser resistance, as illustrated in Fig. 4 in the selection of anchorage resistance for the mesial movement of the left lateral incisor by the closing of the spring loop between the anchorages of greater and lesser resistance *P* and *S*.



Fig. 3.

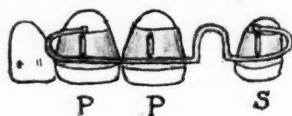


Fig. 4.

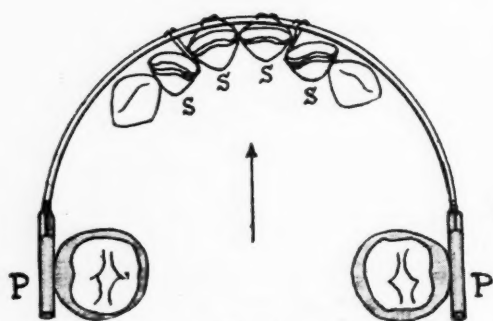


Fig. 5.

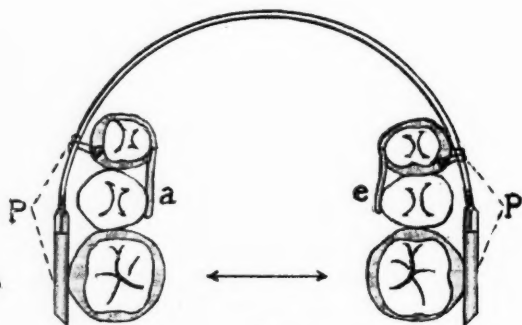


Fig. 6.

In a more complex tooth movement, such as the movement of incisors forward with the expansion arch, the *basal resistance* is *divided* between the *points of support* of the expansion arch, as in Fig. 5, in which the two molars constitute the *primary anchorage* supporting the expansion arch and directing its force against the lesser points of resistance at the points of delivery of the force in the incisors where the *secondary anchorage* is established. If lateral expansion in the molar region is also instituted, there would exist the opposition of the *primary anchorage* on one side to that of the *primary anchorage* on the other, or the establishment of a *reciprocal anchorage*, if the resistance on each lateral half is the same.

The addition of the bicuspid to the *primary anchorage*, in lateral expansion, as in Fig. 6, if the resistance added on each lateral half is equal, simply reinforces, and is included in, the *primary anchorage*.

In case that a greater resistance is intentionally established on one lateral half than on the other for the purpose of moving teeth in the lateral half in which the lesser resistance is established and restricting or inhibiting tooth move-

ment in the opposing lateral half as in Fig. 7, a *primary anchorage* is secured in the lateral half of greater resistance, and a *secondary anchorage* in that portion of the lateral half in which the lesser resistance obtains.

Furthermore, points of *primary* and *secondary* anchorage may be established along the line of the expansion arch for special tooth movements in a particular location as in the anchorage established for the buccal movement of a bicuspid in lingual occlusion, as in Fig. 8. The primary anchorage P^1 and P^2 is partially located in the arch wire, and is opposed to the lesser resistance of the *secondary anchorage* of the lingually occluding bicuspid which is ligated to the arch. It is not uncommon to thus locate part of the *primary anchorage* in the resistance of a heavy base wire, as in the larger gauge expansion arch of Lourie's with delicate finger springs.

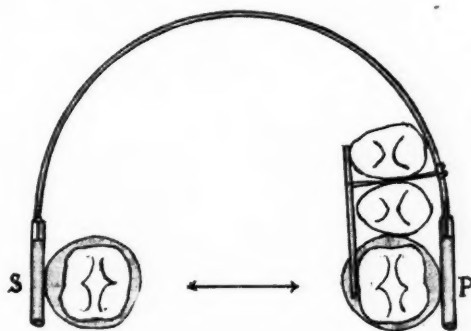


Fig. 7.

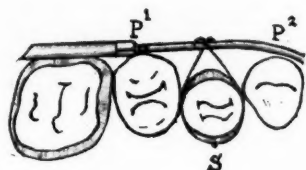


Fig. 8.

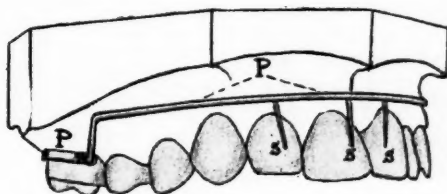


Fig. 9.

Fig. 9 exhibits the *primary anchorage* in Lourie's expansion arch located partially in the anchor teeth and partially in the heavy, almost rigid base wires from which are extended the delicately tapered springs to the points of *secondary anchorage*.

PRIMARY AND SECONDARY ANCHORAGE WITH LINGUAL ARCH

The same conditions of greater and lesser resistance hold good in the use of the lingual arch whether it be the pinched lingual arch of Lourie's or the removable lingual arch of Mershon's with or without finger springs.

In Mershon's lingual arch in which the base wire is constructed, of .036 in. wire or 19 gauge B & S in diameter, and the auxiliary finger springs of .021 in. in diameter, as in Fig. 10, the base wire is not necessarily changed in shape from the beginning to the end of the treatment although it is occasionally done and if *not*, it is part and parcel of the *primary anchorage* established in the molars. The teeth acted upon by the finger springs constitute the *secondary anchorage*

as being the points of lesser resistance to the applied force of *inclination* movement.

In Mershon's lingual arch without finger springs, as diagrammatically illustrated in Fig. 11, the operating force is in the base wire itself, and as the bends conforming to tooth malpositions are straightened out, the pressure of the

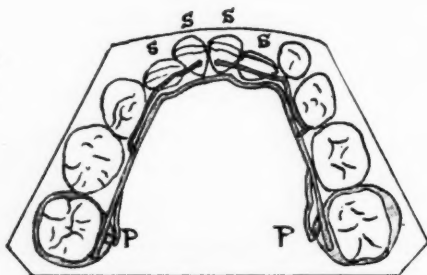


Fig. 10.

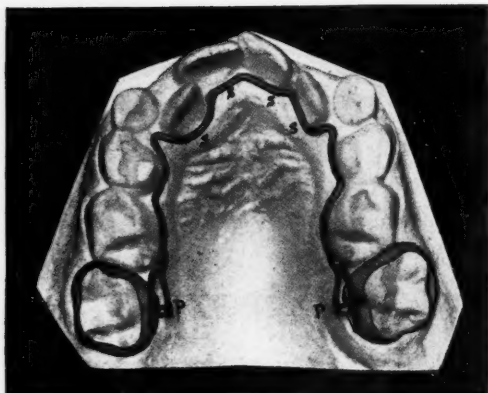


Fig. 11.



Fig. 12.

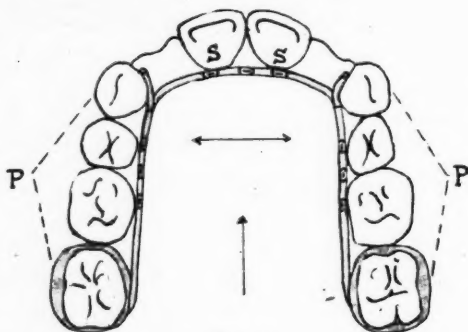


Fig. 13.

spring wire on the lingual surfaces of the anterior teeth causes them to move. The anchorage upon the molars is constructed so that the resistance is greater through the vertical half round lock than the resistance of the incisors to labial inclination movement so that a *primary anchorage* is secured in the molar region and a *secondary anchorage* in the incisor region.

Fig. 12 illustrates a modification of Mershon's lingual arch in which the resistance in the incisor region is made a little more positive by banding the laterals

and attaching lingual spurs, but it is still a selected lesser resistance, and, therefore, a *secondary anchorage*.

In the pinched lingual arch of Lourie's, Fig. 13, the *primary anchorage* is similarly located in the banded molars and the *secondary anchorage* in the anterior teeth when the wire is pinched for forward movement. If in either the Mershon or Lourie lingual arch, force is applied for lateral expansion, the *primary anchorages* on each lateral half are pitted against each other, and other teeth along the side of the dental arch may be included in the *primary anchorage*.

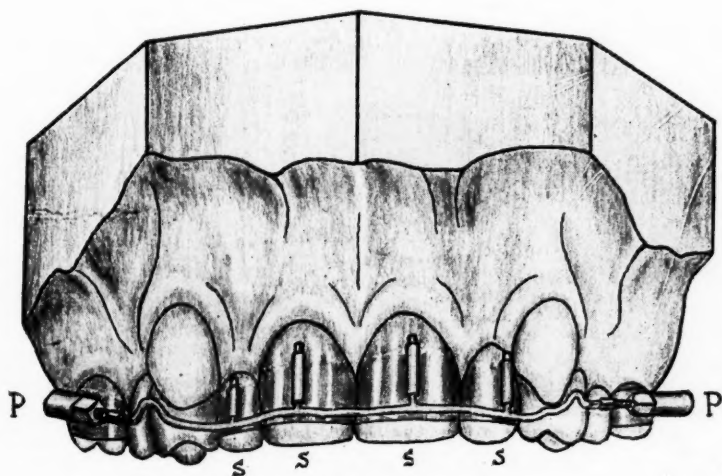


Fig. 14.

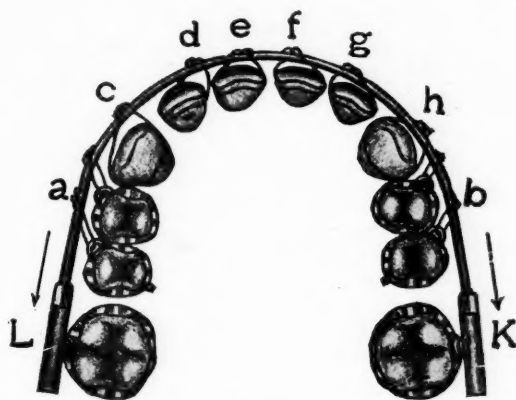


Fig. 15.

In the labial expansion arch with pin and tube attachments with the Angle-Young lock on the molars, as illustrated in Fig. 14, the same conditions of primary and secondary anchorage hold good as in the plain labial expansion arch, or in the lingual arch, for as long as the basal attachments in the molar anchorage are non-pivotal, and the force applied for the bodily movement of the incisors is infinitesimally increased from time to time, the resistance in the molar region will continue stable during the movement of the anterior teeth, and a *primary anchorage* is thus established at points *P* and *P* in the molar region, and a *secondary anchorage* at the points of lesser resistance *s*, *s*, *s*, *s*.

REVERSAL OF BASE OF ANCHORAGE

Occasionally it is necessary to reverse the usual base of anchorage of an appliance and use the teeth as *primary anchorage* which under ordinary conditions would be used as *secondary anchorage*. For example, in Fig. 15, the reversal of the base of anchorage from the molars to the anterior teeth is purposely effected so as to move the second molars distally. This is done by ligating all of the teeth to the expansion arch and reducing the resistance of the molars to distal movement by means of a pivotal anchor tube on each second molar. In this manner the *primary anchorage* is located in the anterior teeth and the *secondary anchorage* in the second molars.

It is, of course, also possible to reverse the base of anchorage with other types of appliances than the plain expansion arch, such as the pin and tube appliance, and great care must be observed in its use to see that the base of anchorage is not unintentionally reversed.

From the foregoing descriptions of *primary* and *secondary anchorage* it will be seen that they are *not* forms of anchorage, but rather designations of the distribution of anchorage resistance according to the mechanical and physiological requirements of treatment.

Up to this point in the study of the principles of anchorage, stress has been laid upon the *selection of anchorage resistance* and its distribution in the dental arches as *primary* and *secondary anchorage*, based upon the varying degrees of resistance of the teeth themselves, and the osseous structures in which they are embedded. Anchorage resistance has been considered chiefly from its physical aspects in comparing the resistance values of the teeth themselves, according to their size and location, their periods of development, and the necessities of treatment.

A further consideration of the principles of anchorage deals with the *added resistance mechanically obtained by the method of attachment of the appliance* and the *scientific building up of anchorage by mechanical means*.

MECHANICAL REQUIREMENTS OF ANCHORAGE

In the mechanical building up of anchorage resistance to the application of force, the necessities of treatment must first be considered as to the degrees of resistance required in the anchorage for the *potential* and *direction* of the applied force. For example, if *inclination movement* is to be carried out, a lesser degree of anchorage resistance will be required than for *bodily movement*.

Inclination movement of the anchor teeth calls for a *pivotal attachment*, while *bodily movement* of the anchor teeth requires a rigid, *nonpivotal attachment* so that the anchor teeth may be moved bodily through the osseous structures. Again, if the force is applied in two directions to the anchor teeth, the resistance in the anchorage must be mechanically built up to sustain the stress in both of these directions.

Provision must therefore be made through the method of attachment to the anchor teeth for their *inclination* or *bodily movement* in both the *mesio-distal* or *bucco-lingual directions* according to the indications of treatment.

Thus, it will be observed that there may be a *minimum degree* of resistance built up in the anchor teeth through the use of an attachment requiring *inclina-*

tion movement only, and a *maximum degree* of resistance built up in the anchor teeth by mechanical means through the use of an attachment requiring *bodily movement* of the anchor teeth,

Again, the *minimum degree* of resistance mechanically built up in the anchor teeth by the method of attachment should always be *sufficiently stable* for the accomplishment of the necessary tooth movements in the dental arch other than the movement of the anchor teeth themselves, as indicated by the requirements of treatment.

For example, the *minimum degree* of resistance in the *primary anchorage* should usually be made to be *resistance plus*, or the *maximum resistance*, by mechanical reenforcement, so that it will be sufficiently stable to offset an unknown and often powerful resistance in the *secondary anchorage*. Anchor bands should be close fitting and cemented upon the anchor teeth, and anchor tubes should be attached so as to secure the maximum of resistance for use.

The attachment of the simplest appliance upon the teeth, then, requires the anchoring of the force producing appliance in such a way that the force can be continuously and effectively used to accomplish the desired tooth movements without endangering the stability of the anchor teeth to any appreciable extent.

Hence, the direction and the amount of the force exerted must be positively controlled in these attachments by a mechanically stable anchorage, the degree of stability being always proportionate to the stress of the applied force.

This necessity for the comparatively stable anchorage of a force appliance in the mouth so that its force can be effectively used and controlled, both in direction and potential, has given rise to a fundamental principle relating to the stability of appliances and their attachments, which the writer has designated the *principle of fixation*, and defined as follows:

The principle of fixation is the general condition of stability in the delivery of force for tooth movement secured by the proper gauging of resistance values in the primary and secondary anchorage.

The *principle of fixation* is the summing up, as it were, of all of the mechanical principles which relate to the stability of appliances for orthodontic treatment, of the quality and quantity of applied force, and of the proper proportion between the units of applied force and anchorage resistance.

The *principle of fixation* thus refers to *stability* in anchorage attachments, and in the attachments upon the teeth to be moved, and thereby to the direction and control of forces used in the development of the dental arch, or in lesser tooth movements.

A fixed appliance, then, is one which in its construction, takes advantage of every applicable principle of mechanics to prevent instability in the delivery of force for tooth movement.

In the observation and following out of the *principle of fixation* in the construction and attachment of appliances to the teeth, the *proper relation* between force and resistance is always obtained.

In every appliance, therefore, there must be an adequate force principle and a resistance quality in the anchorage sufficient to act as a stable base for the operation of the force. Hence, in the adherence to the *principle of fixation*, the various degrees of anchorage resistance are *selected*, from the *minimum* to the

maximum, which forms the *only logical basis* for the classification of the various forms of anchorage.

CLASSIFICATION OF ANCHORAGE

Anchorage may accordingly be *classified* in reference to the more definite degrees of resistance selected through the

Special Form of the Attachment Used, as	{ <i>Pivotal,</i> <i>Reinforced,</i> and <i>Stationary</i>
From the Source of Resistance Selected, as	{ <i>Intermaxillary,</i> <i>Occipital,</i> and <i>Cervical</i>
By the Reciprocation of Anchorage Resistance, or <i>Reciprocal Anchorage.</i>	

This classification is not essentially different from those with which you are already familiar, and but two forms of anchorage, *pivotal* and *stationary*, will be elaborated upon in this essay in order that they may be made more clearly comprehensible.

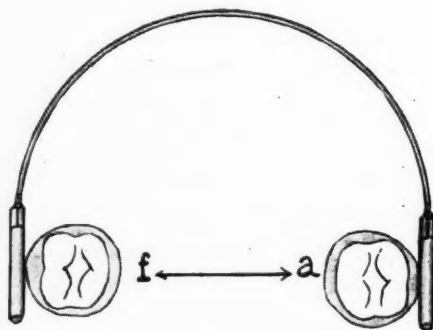


Fig. 16.

The definition, description, and illustration of these two forms of anchorage will show their special value and the reason for their consecutive sequence in the classification as follows:

Pivotal Anchorage is that form of anchorage in which the attachments to the primary or secondary anchorage are of a hinge-like or pivotal nature.

Pivotal Anchorage may be divided into two forms according to the plane of attachment to the teeth as follows:

1. *Horizontal Pivotal Anchorage* (pivotal in horizontal plane).
 - (a) Simple (pivotal in one direction in horizontal plane).
 - (b) Compound (pivotal in two directions in horizontal plane).
2. *Vertical Pivotal Anchorage* (pivotal in vertical plane).

These designations of the subdivisions of *pivotal anchorage* exactly describe them, which is an advantage in favor of the use of these terms, rather than to continue the use of some of the older terms, such as *simple anchorage*, which, would perpetuate a term which has lost its value since it represents an early form of unsupported anchorage which is not accurate enough for present day usage.

Further definition and description of these forms of pivotal anchorage, aided by illustrations, will serve to show the need for their special designation, as follows:

A *Simple Horizontal Pivotal Anchorage* is an anchorage which is *pivotal* in *one direction* in the *horizontal plane* only, as bucco-lingually or mesio-distally. An example of a *simple horizontal pivotal anchorage* may be observed in the use of *round buccal tubes* soldered to molar bands, supporting a plain expansion arch, as in Fig. 16, the force being applied buccally for expansion. The round buccal tubes allow of the rotation of the expansion arch in lateral expansion, and a consequent slight tipping of the anchor teeth in one direction only, bucco-lingually. The ligation of the incisors or other teeth to the arch, where force is applied in one direction only, is also an illustration of this form of pivotal anchorage.

A *Compound Horizontal Pivotal Anchorage* is an anchorage which is *pivotal* in *two directions* in the *horizontal plane*, bucco-lingually and mesio-distally. An illustration of this form of pivotal anchorage may be seen in the use of a *pivotal round buccal tube*, attached as in Fig. 17, so that it can pivot in either a mesio-distal or a bucco-lingual direction. This form of pivotal anchorage gives an

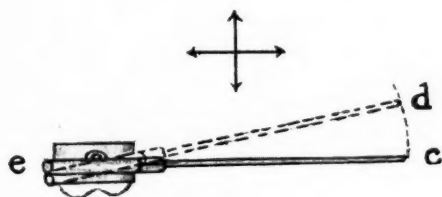


Fig. 17.

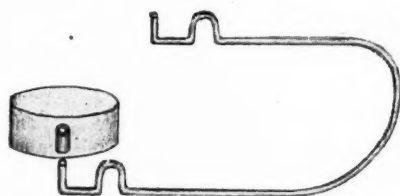


Fig. 18.

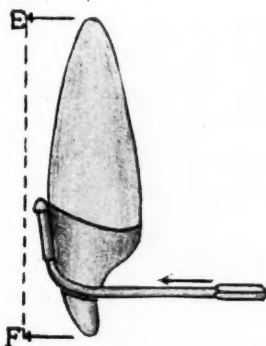


Fig. 19.

anchor tooth the greatest freedom in its movement, as it presents the least resistance to the applied force in either the mesio-distal or the bucco-lingual direction.

Vertical Pivotal Anchorage is that form of *pivotal anchorage* in which the anchorage attachments are *pivotal only in a vertical plane*, allowing of *bodily movement of the anchor teeth, and their rotation upon their vertical axes*.

This form of pivotal anchorage is observed in the use of *round vertical tubes* attached to bands upon the teeth, both in the *primary* and *secondary anchorage*.

In Fig. 18 *vertical pivotal anchorage* is illustrated in the attachment of the threadless expansion arch, the round end of the arch fitting into the round buccal tube soldered vertically to the surface of the molar band. If the round vertical tube be attached in the axial center of the band on the anchor tooth, and a lateral expanding force applied, the anchor tooth will not rotate, but will move bodily in a buccal direction; if, on the other hand, the round vertical tube be attached nearer the mesial angle of the anchor band, the application of the laterally expanding force or a distally exerted force will tend to rotate the anchor tooth.

In the *secondary anchorage* with the pin and tube appliance the use of the round vertical tube and round pin on incisor bands is an illustration of *vertical pivotal anchorage*, as shown in Fig. 19.

STATIONARY ANCHORAGE

The maximum bucco-lingual and mesio-distal reenforcement of a *simple horizontal pivotal anchorage* tends to increase the stability of the anchor teeth to such an extent that the nearest approach to absolute stability is secured, which may be designated as *stationary anchorage* and defined as follows:

Stationary Anchorage is an anchorage which is so reenforced against pivotal tendencies that the attachment to the anchor teeth secures the nearest approach to an absolutely stable anchorage.

This form of anchorage is essentially rigid so that the anchor teeth are either absolutely stable in relation to the applied force, or are moved bodily through the alveolar process in an upright position without rotation.

The resistance, for example, in a *primary anchorage* must be so reenforced

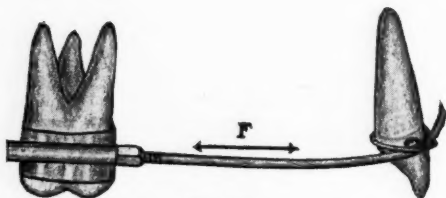


Fig. 20.



Fig. 21.

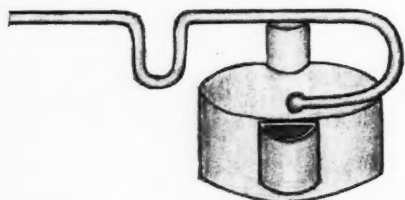


Fig. 22.

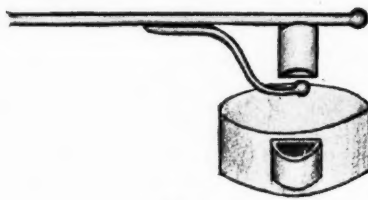


Fig. 23.

mesio-distally and bucco-lingually that tipping is impossible, and this is secured by the method of attachment. Thus, in the use of the round buccal tube soldered to the anchor band in Fig. 20, the resistance to the mesio-distally applied force is essentially stable, provided the expansion arch closely fits the round buccal tube, and in effect there is a mesio-distal *stationary anchorage* established. However, if a bucco-lingual force is exerted upon this anchorage, it is only a *simple horizontal pivotal anchorage* which will allow of the tipping buccally of the anchor teeth.

In order to make this anchorage a complete *stationary anchorage* the expansion arch and buccal tube supporting it must be of the nonpivotal variety. The buccal tube may be oblong but preferably oval, while the vertical tube may be oval or half-round, in the use of which the resistance to either a mesio-distal or bucco-lingual force is unyielding, and an absolutely stable anchorage, that is, as far as mechanics can make it, is secured, provided the anchor band is well fitted and cemented in position, and the buccal tube attached as nearly as possible in the horizontal plane.

Examples of the horizontal oblong or oval tubes may be seen in Fig. 21, and in this case the ends of the expansion arch must also be of the oblong or oval form in order to fit the tubes.

The vertical half-round buccal tubes for the labial expansion arch are illustrated in Fig. 22, the end of the .030 inch arch wire being curved upon itself to form a lock when the engaging half-round rod is in its place in the half-round tube (the Angle-Young lock).

The half-round vertical tube and engaging rod is similar for the lingual arch as used by Mershon, although the lock may be constructed of a separate and smaller gauged wire, as shown in Fig. 23.

Stationary anchorage is secured in the *secondary anchorage* by the use of round vertical tubes or rectangular brackets attached in the center of incisor, cuspid, or bicuspid bands. In Fig. 24 are illustrated the round vertical tubes on incisor bands, and through the use of which stationary anchorage is secured so that the teeth may be moved bodily, although with some lateral mobility on account of the vertical pivotal anchorage established.



Fig. 24.



Fig. 25.

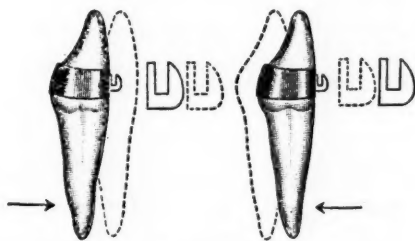


Fig. 26.

In the Angle ribbon arch, *stationary anchorage* is secured in the *primary anchorage* through the curved rectangular horizontal buccal tubes, Fig. 25, and in the *secondary anchorage* by the use of rectangular mortised brackets, as shown in Fig. 26.

Stationary anchorage has been described in the light of an absolutely stable resistance, but as has before been intimated, the stability of the most mechanically rigid anchorage is only relative on account of the elastic and unstable nature of the resistance of the vital tissues in which the teeth are embedded.

SUMMARY

In the foregoing discussion of the principles of anchorage in modern orthodontia it was found that the *basic principle* of anchorage is founded upon Newton's law that "*action and reaction are equal and opposite*," that *anchorage* was *selected resistance*; that this selection of resistance was better understood if the selected basal resistance was designated as *primary anchorage*, and the points of selected lesser resistance opposed to the basal resistance at the points of de-

livery of the force designated as *secondary anchorage*; that the resistance in anchorage can be built up by mechanical means to the degree necessary for either *inclination* or *bodily movement* of teeth; that *inclination movement* requires the *minimum degree* of resistance only in the *anchor teeth*, while *bodily movement* requires the *maximum degree* of resistance in these teeth; that *inclination movement* calls for a *pivotal attachment*, and *bodily movement* demands a *rigid, nonpivotal attachment*; that the *minimum degree* of resistance in the *primary anchorage* should be made to be *resistance plus*, by mechanical reinforcement, so as to be sufficiently stable to offset an unknown and often powerful resistance in the *secondary anchorage*; that this gauging of resistance values to produce *stability* in the *delivery* of a *force* for tooth movement could be defined as the *principle of fixation*; that, in the *selection* of the various degrees of anchorage resistance from the *minimum* to the *maximum*, the only logical *basis* for the *classification* of *anchorage* was found; that the classification of anchorage could therefore be made according to the more definite degrees of selected resistance; first, through the form of attachment used, as *pivotal, reenforced, and stationary*; second, from the source of the resistance selected, as *intermaxillary, and occipital cervical*; and third, by the counterbalancing of anchorage known as *reciprocal anchorage*.

This classification is not materially different from those already in use except that it is modified and simplified as much as possible to avoid confusion in the minds of those who have difficulty in understanding the application of the laws of physics and mechanics to orthodontia.

One's conception of anchorage in orthodontia must needs have changed in conformity with the radical changes in methods of treatment due to changes in the theory of the physiology of tooth movement and consequent modifications in the application of force to the teeth, and it has been my purpose, insofar as it has been possible in a limited discussion of the subject, to analyze and interpret some of the basic principles of anchorage in this paper, by such description, definition, and illustration as would enable one to see these principles in their proper perspective and understand their relative importance in the study of the mechanics of modern orthodontia, rather than to designate the choice of any of the appliances shown for orthodontic treatment.

DISCUSSION

Dr. Martin Dewey, Chicago, Ill.—In opening the discussion on Dr. Pullen's paper I wish to say that anchorage is one of the most fundamental principles, and one of the most important things, in the practice of orthodontia.

In the first place, Dr. Pullen has given us a classification of anchorage in which he has attempted to simplify to a great extent in order to avoid complexities, but you can carry simplification to such an extent as to lose by it, and it is much better to have a thing a little more complex and have it complete.

In classifying anchorage we have to base the classification upon two things. First, the sources from which we obtain resistance, and second, how we obtain that resistance.

Dr. Pullen spoke of intermaxillary, occipital and cervical anchorage which forms can be better classified in this way: First, as regards sources, we divide the sources into extra-oral and intra-oral, the extra-oral would be known as anchorage obtained outside the oral cavity. In that group we have occipital and cervical and facial anchorage. Intra-oral is

intramaxillary and intermaxillary. In intramaxillary anchorage the resistance is in the same arch as the malposed tooth. In intermaxillary anchorage the teeth you wish to move are in the opposite arch from the anchorage.

As regards the application of anchorage, Dr. Pullen describes pivotal anchorage and stationary anchorage. I am not ready at the present time to say that pivotal anchorage is superior to simple anchorage. In using either term, simple or pivotal anchorage, that style of anchorage depends upon anatomic conditions. It is the one form of anchorage where you construct the appliance without any view toward increasing resistance. It is an anatomic resistance entirely.

In stationary anchorage you so construct and make your appliance that you increase the resistance. Stationary anchorage may be defined as that form in which the appliance is so constructed and attached that the anchored teeth must move bodily through the alveolar process. Pivotal anchorage is an anatomic matter, and stationary anchorage is anatomic plus mechanical.

I agree with the essayist in regard to the mode of analyzing appliances for cases from the standpoint of anchorage. If you analyze a lot of the appliances that have been placed on the market and recommended from the standpoint of physical requirements and anchorage, as well as mechanics, you would not use them. According to the advertisements that appear in the dental journals, somebody tells you the appliance you ought to use and how to use it before analyzing it. If you were to analyze some of these appliances you certainly would not use them.

In the definition which I gave of stationary anchorage you have to distinguish between stationary anchorage and stationary attachment, or stationary anchorage and rigid attachment, because your anchorage is a resistance to overcome the applied force and the attachment holds the appliance to the anchored tooth when we use a vertical tube and the vertical end of the alignment wire going into the tube. Mesio-distally you have tipping of the molar so far as anchorage is concerned; if you use a small gauge alignment wire or wire with a loop, and have only stationary attachment, because the alignment wire is so weak that the molar will tip on account of the appliance not being rigid enough. In stationary anchorage you go further than attachment to the molar tooth and construct the appliance with enough rigidity so that it will not spring and prevent the molar from tipping. If you exert force on the anterior segment of a light gauge alignment wire, even if you have a vertical tube preventing mesio-distal tipping of the molar, instead of having stationary anchorage you have only stationary attachment, and the tooth tips. I have seen several undesirable and unsatisfactory results from this. Men think they have stationary anchorage because they have stationary attachment on the molar, and I have seen these molars tip forward and backward because the appliance was not made rigid enough to follow out the principles of stationary anchorage.

The same is true with half-round tube and half-round spur going into the tube vertically and making stationary attachment, which tends to discourage the movement of the molar in any direction except in a bodily manner, but with a light wire and loop the wire becomes very elastic and you lose the stationary anchorage and have only stationary attachment because the molar can tip owing to the fact that the alignment wire can spring.

After the pin and tube appliance had been used probably a year, we found several articles in dental journals where the users were cautioning men against displacement of the anchored tooth. The anchored tooth became displaced because they had used a rigid attachment, which did not make a stationary anchorage. There was so much resistance offered by the malposed teeth that the molar would tip because the alignment wire was not rigid enough to supply the rigidity in the appliance.

One disadvantage of any appliance in which you have finger springs and everything combined in one appliance is that you have so much spring in the small gauge wire that when you adjust it you do not know where your primary anchorage or resistance is. The question simply resolves itself into an anatomic proposition, namely that a tooth that has the least resistance will move first. That may be a molar or something else.

Going again into the question of terminology, we would define anchorage as resistance to overcome an applied force. I do not know where I got that definition. Anchorage is

not a force but a resistance, and as a result of this force which is overcome by the resistance, we aim to achieve some particular object. The object we move, so this force to my mind is not applied to a secondary anchorage. In other words, Dr. Pullen has mentioned primary anchorage, and secondary anchorage. The force is exerted on the resistance and the anchorage must overcome this force. So I think that calling the moving object a secondary anchorage is not mechanically correct.

These terms are interesting when you come to reciprocal anchorage which is to my mind a sort of mechanical misnomer, because in reciprocal anchorage one of the malposed teeth is pitted against the other. The manner in which we are using the term reciprocal anchorage is mechanically incorrect, but as regards the condition which we have become accustomed to consider, I do not know what else to suggest. The term of calling it primary anchorage and secondary anchorage is so mechanically incorrect that it would be a mistaken idea to adopt it.

Dr. Pullen has called our attention to the fact that anchorage may vary. You may have an attachment on the incisors which becomes an anchorage appliance to move the molars.

In these cases of high labial arch finger and springs as used by Dr. Lourie, his idea has changed some since he first brought forward this appliance, and I will show you some of the later uses of it. Of course, one important thing is that this alignment wire is heavy enough to absorb the force exerted by this finger spring without distorting the alignment wire and changing the conditions in the tube. You adjust these finger springs and the main part of the appliance absorbs the force, and no reaction is carried over to the approximating tooth but eventually as this thing goes on your point of resistance is only in the molars. To overcome the tendency towards bucco-lingual displacement as a result of the slight spring in this wire, we now in practically all cases (I know I do) stabilize these molars. I may use the lingual appliance for the sole purpose of increasing the resistance.

Dr. Milo Hellman, New York City.—I wish to make a few remarks with reference to some of the more fundamental principles on this subject.

Since Newton enunciated the law of action and reaction (1687), it is so long that one might be led to believe that there has been no progress made in physics during all these years. Newton said: "To every action there is always opposed an equal reaction; or the mutual actions of two bodies upon each other are always equal, and directed to contrary parts." Its modern expression is that action and reaction are equal but in opposite directions.

Recently one of the greatest physicists in this country contributed an addition to this law, and I think it would be well for all who are dealing with physical principles to know it. Professor M. I. Pupin of Columbia University, who perfected the coil by which it was possible to extend direct telephone lines between New York and San Francisco, has made an addition to Newton's law. He shows that the law bearing on action and reaction, is also of great significance in its application in *interaction*. If we ponder sufficiently on this matter we may have a clear idea of what really action and reaction mean. We did not, hitherto, realize that there is something in between action and reaction. The law as it now stands is equally applicable in biology, chemistry and in physics. Thus, says Professor Osborn, "*Actions* and *reactions* refer chiefly to what is going on between the parts of the organism in chemical or physical contact, and are subject to the two dynamical principles referred to above. *Interactions*, on the other hand, refer to what is going on between material parts which are connected with each other by other parts, and can not be analyzed at all by the two great dynamical principles alone without a knowledge of the structure which connects the interacting parts. For example, in interaction between distant bodies the cause may be very feeble, yet the potential or stored energy which may be liberated at a distant point may be tremendous. Actions and reactions are chiefly simultaneous, whereas interaction connects actions and reactions which are not simultaneous; to use a simple illustration: when one pulls at the reins the horse feels it a little later than the moment at which the reins are pulled—there is interaction between the hand and the horse's mouth, the reins being the interacting part. An interacting nerve impulse starting from a microscopic cell in the brain may give rise to a powerful muscular action and reaction at some distant point. An inter-

acting enzyme, hormone, or other chemical messenger circulating in the blood may profoundly modify the growth of a great organism."

Likewise in orthodontia, we have action and reaction between the influence of the appliances and the response in the movement of the teeth, but this occurs through the *interactive* capacity of the cells constituting the tissues surrounding the teeth.

I do not mean to criticize in any way the remarks made by Dr. Pullen. I think they have been very clearly brought out. I rose particularly to call your attention to the idea involved in *interaction*, and indicate that physics has not remained exactly where Newton left it, for by this modification his third dynamic law is today applicable not only in a Newtonian sense alone but also in a more general sense including biological phenomena.

Dr. F. C. Rodgers, St. Louis, Mo.—I listened to Dr. Pullen's paper with considerable interest because of his presentation of a simplified classification of "the forces of anchorage."

The present classification is complicated and unusually hard for students to understand, and changes along the line of simplification are urgently needed, and the ideas of the essayist seem to be in that direction.

Dr. Pullen (closing).—I am very much pleased to have had Dr. Dewey discuss this subject, because when we take up a matter like this it shows how two men studying the same subject will look at it from different angles.

In the beginning of my paper I stated distinctly that stability of force or resistance in the mouth is in the relative only and not absolute, and as long as it is so we can not discuss it in the absolute except theoretically.

As regards the designation, and not definition, of secondary anchorage, in attempting to analyze the selected points of greater and lesser resistance and making it the basis of my study, I tried to designate the points of lesser resistance and in that way handle the matter. We have the points of greater resistance in the basal or molar anchorage as a rule. When it came to naming the points of lesser resistance which had never been named or designated, except to designate them as points of lesser resistance, I named them secondary anchorage because they represented a resistance of lesser degree than in the primary anchorage. Perhaps some of you, when you read this paper and look at the illustrations, may appreciate these points better. It has been a matter of a great deal of study, and I have not been able to analyze it in any other way. The paper is an analysis of anchorage principles in modern appliances, and not intended to point out any particular appliance, but rather to analyze the anchorage of many different appliances and adapt new terms which seemed needful on account of the absence of proper terminology to designate the relations of force and resistance in the application of modern appliances. I am sure, you have been taught, in your school exactly what appliances are best, and what are the worst appliances, and are able from a comparison to form the basis of good judgment in the selection and use of appliances which is one object of this meeting today.

I have been working analytically on this subject for twenty years and am still improving my judgment along these lines, making an attempt to analyze all of the appliances I use, and if an appliance is deficient in a certain point, correcting it. In this analysis, as I told you, I define *anchorage* as *selected resistance*, referring especially to the teeth and later to building up the selected resistance at the basal anchorage by the method of attachment, and for secondary anchorage, using less resistance rather than in the primary or basal anchorage.

Dr. Dewey said that the classification of anchorage into extramaxillary, intramaxillary and intermaxillary is an advantage. Personally, I can not see that it is. I have tried to simplify anchorage for teaching purposes, and I have eliminated every term that I could. I think you will find, if you will go over my paper with this idea in mind, I have simplified rather than elaborated the classification. Dr. Dewey says we may simplify a thing too much and thereby leave out some of the details worth mentioning. That is undoubtedly true, but why doubly classify in the use of such terms as extramaxillary, as for example, occipital anchorage is extramaxillary, but that the location of this anchorage is outside of the mouth is perfectly obvious without giving it any extra designation such as extramaxillary in the Dewey classification.

I am conducting no brief for the pin and tube appliance or the ribbon arch appliance, but their analysis is important from the standpoint of anchorage.

Dr. Dewey brought out a point in relation to the use of the pin and tube appliance where we can get simple expansion of the arch, or change the primary anchorage to the anterior teeth and move the molar tooth. You can not tell in these pin and tube attachments how much resistance you have in the secondary anchorage. The same is true with the ribbon arch. There you have interaction as Dr. Hellman so well brought out in his discussion. It is a splendid point to remember in studying the mechanics of orthodontic appliances.

With reference to the use of loops I regard them as dangerous things if not properly used. We have used loops in appliances rather promiscuously for a time, but now we only use them in a few cases. They have their advantage if used rightly. Some loops are used in connection with appliances when they ought not to be. I do not think a small loop in an appliance that has never been used destroys the firmness of the arch to any appreciable extent or causes an interaction of the forces or a change in the resistance, but I do admit that a wrong bending of the loop is immediately liable to change the resistance or tip the anchored tooth.

As to the cemented band in relation to the crib or Jackson appliance, cemented bands hold other appliances so that there is no play at all. With a full crib appliance there is a certain amount of play, and if a cemented band is used as a basal attachment of the crib with lugs for it to be attached to, it becomes in effect a fixed appliance through the locking device thus made.

THE INTERRELATION BETWEEN ORTHODONTIC MALFORMATIONS AND DISEASES OF THE NOSE AND THROAT*

BY GEO. C. DITTMANN, M.D., ST. PAUL, MINN.

THAT malformations of the dental arches and the maxillae are a great etiologic factor in producing many nose and throat affections may be realized by a review of the closely correlated anatomy of the bones forming the face.

To better understand this orthodontic interrelationship a brief embryologic survey is necessary. The evolution of the face depends largely upon the parts concerned in the formation of the mouth and nose. The first step in the differentiation of the face is the formation of the oral plate which makes its appearance on the twelfth day, later this becomes the mouth. At the third week the first and second visceral arches appear, the first arch divides into the mandibular arch and the maxillary process, the second arch springs from the mandibular arch; as these processes grow toward the median line the maxillary process becomes the upper jaw and the mandibular process the lower jaw. At the second month a groove makes its appearance on the frontal protuberance and on each side of this there is formed two nasal processes, the outer pair becomes the outer wall of the nose and the inner pair the septum, as these processes grow downward the union of the two upper portions of the mandibular arch forms the floor of the nose.

By the second month of intrauterine life the septum becomes cartilaginous and by the third month ossification begins in the vomer, into the groove of the vomer the perpendicular plate of the ethmoid fits anteriorly, the rostrum of the sphenoid unites above and the nasal crest of the superior maxillary and palate bones unite below.

At birth the ethmoid part which goes to make up the nasal space is higher than the maxillary portion but it becomes of equal dimensions with age, this increase is due to the descent of the hard palate. As the teeth erupt the nares develop, the superior maxillae enlarge and the antrum of Highmore forms, gradually increasing in size; with enlargement of the nasal chambers and formation of the alveolar process development is completed.

It will be noted that the septum is the last of the facial bones to ossify, the fact that ossification begins posteriorly explains the rarity of deformities in this part of the bone.

Thus the nasal chamber depends wholly upon the proper growth of these processes and the adjoining parts and any pathologic condition or malformation tends to affect either by extension or anatomical conformation the sinuses or orbital cavities with subsequent effect upon the ears interrelated as they are with these parts.

In the examination of the nares a deflected septum will be noted, but often if the oral vault is examined it will be found highly arched and the alveolar processes close together.

*Read at Joint Meeting of Ramsey County Medical Society and Ramsey County Dental Society, Sept. 30, 1918. Reprinted from *Minnesota Medicine*, August, 1919, ii, No. 8.

I have often noted that when doing the submucous operation for deflected septum where the maxillary ridge is thickened and broad there is usually associated with the condition a high arched vault and it must be further remarked that these are the most difficult bony ridges to remove, considerable hemorrhage takes place and when a chisel is used it may be broken in the attempt to level the ridge.

A high arched vault with narrow alveolar processes must tend to so crowd the turbinate bodies and septum together that the respiratory space within the nose becomes greatly decreased which in turn causes mouth breathing and its subsequent results—dry pharynx, enlarged tonsils, adenoids and fetid breath.

It is stated that tonsils and adenoids are the most common cause for mouth breathing in the young, but is it not possible, because of anatomic nasal defects that the enlargement of these tissues might be due to an increased hyperemia mainly as a result of the orthodontic anomaly? What effect treatment of the dental arches has upon the nasal spaces and septum can be appreciated by the joint observation of orthodontist and rhinologist of these cases.

Trendelenburg states that a persistent high arch of the hard palate is the cause of a deflected septum. Ballenger concluded that it is due to incoordination in the development of the bones of the face, this is a fair conclusion when it is realized that the most important area within the nose and known as the viscous area is but one inch in diameter and any obstruction to this region might cause an infection of the nasal sinuses and because of their close anatomical relationship would produce an intrusion upon or actual rupture into the orbital cavity, although more often monocular, both eyes may be affected.

Ocular complications are more frequent in chronic than acute sinus infections, perhaps the most misleading ocular complaint resulting from sinus involvement is asthenopia or an inability to use the eyes for near work for any length of time.

As the sinuses under normal conditions are designed to contain air, any secretion of whatsoever nature remaining for any length of time is pathologic and the importance of early and free drainage should be recognized.

The throat is primarily affected by attempting to clear it of the increased secretion and mucus, dropping from the posterior nares.

From a neurologic view directly as a result of nasal obstruction or malformation the trigeminus that great sensory nerve of the head with its vast number of distributing branches may be directly affected through reflex conditions.

How best to treat these conditions. In children the tonsils and adenoids if enlarged should be removed at an early date, any malformation of the alveolar arches or teeth should be taken care of by the orthodontist; the proper time is during the development of the bony structures and the teeth, since this period extends over several years the greatest importance should be placed on proper occlusion best obtained and constructed at this stage of life.

It can not be advisable to perform a submucous resection of the septum too early in life or remove enlarged turbinate bodies; it is surprising how rapidly the turbinate bodies will shrink down to normal after removal of the tonsils and adenoids.

With adults who have gone through life with high arched palate and contracted dental arches, treatment is still a matter for discussion. L. W. Dean in the *Journal of the American Medical Association*, Nov. 26, 1910, reports a case in which nasal breathing was impossible but by widening of the palatal arch the patient became a nasal breather; as regards the narrow chambers with deflected septum, enlarged turbinates or polypi secondary to sinus infection I believe it has been definitely settled that these conditions should be corrected by operation. Perhaps no operation produces such striking results as the submucous operation for the correction of septal deformities where there has been a narrowed nasal chamber with sinus infection and improper aeration of the middle ear, the technic has been universally adopted.

CONCLUSIONS

1. This is an era which must recognize dentistry as an aid to medicine and vice versa.
2. This is a subject which closely associates the orthodontist and rhinologist and for best results in the young a cooperation of the two specialties is imperative.
3. Nasal and throat operations in conjunction with orthodontic correction often give best results to patient.
4. Orthodontic deformities and respiratory function are correlated.

DEPARTMENT OF ORAL SURGERY AND SURGICAL ORTHODONTIA

Under Editorial Supervision of

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THE COMBINED OPERATION FOR PERIAPICAL AND PERIODONTAL INFECTION; THE REASON FOR THE AUTHOR'S TECHNIC

BY DR. ARTHUR ZENTLER, NEW YORK CITY, N. Y.

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AS AN introduction it may be well to explain that the term "periapical infection" will be used to indicate such conditions which through clinical and roentgenographic examination disclose a pathologic involvement necessitating for rational treatment an apicoectomy followed by thorough curettage of the apical area. The term "periodontal infection" will be used to indicate such conditions which through the same diagnostic means disclose an absence of investing tissue and a presence of suppurating subgingival pockets starting at the cervical margin, necessitating for rational treatment a thorough removal of existing irritants and thorough curettage of all the soft and hard underlying involved tissues.

Teeth which through disease or other causes have become devitalized and their periapical region become infected, often have also suffered from loss of investing tissue around a smaller or larger surface of their roots, starting at the cervical margin, suppurative gingivitis (pyorrhea) being present. Such teeth may be said to be affected by "periapical and periodontal infection."

In such cases, unless the involved tooth or teeth are removed, it is evident that in order that they be made safe so that their retention may not constitute a danger to the general health, there is little sense in performing an apicoectomy and curettage of the periapical area, unless the periodontal infection is also thoroughly eliminated. To attempt this by making any of the adopted and up to the present time described types of incisions, means certain failure to reach

the affected parts originating at the cervical margin, and the further from the apex and therefore nearer to the cervix the infection is located, the more difficult will it be to obtain a satisfactory result with the presently practiced methods of entering the infected areas. In cases where healthy alveolar bone intervenes

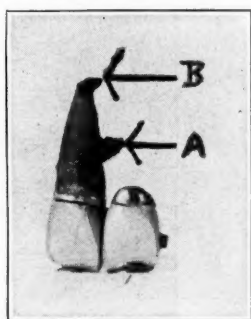


Fig. 1.—Case of Dr. R. W. Wadell of New York City.



Fig. 2.—Roentgenogram of case before extractions. (Same case as in Fig. 1.)

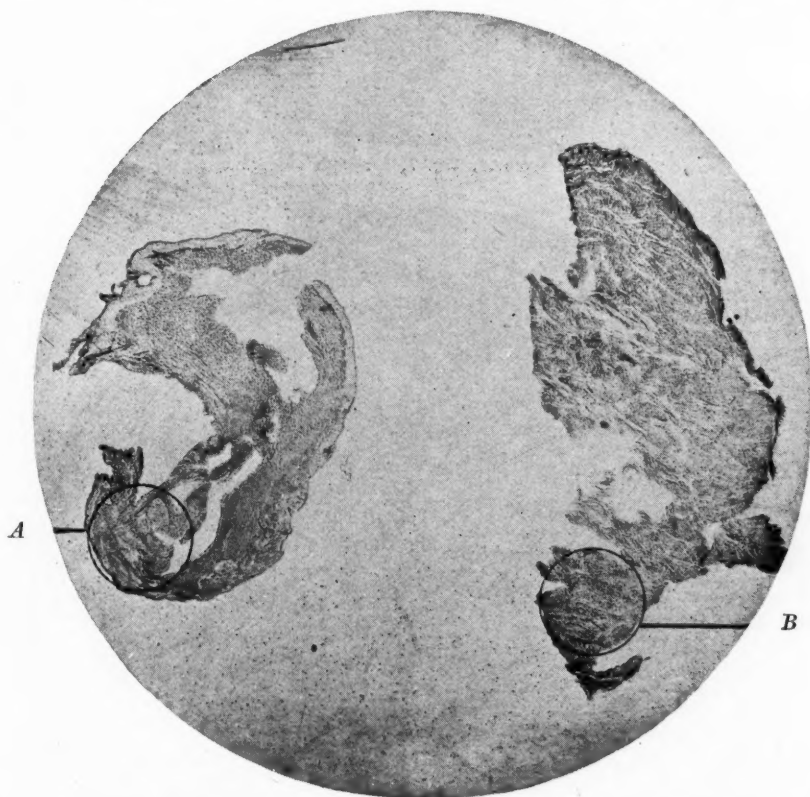


Fig. 3.—A, Section of full growth from Fig. 1, A.; B, Section of full growth from Fig. 1, B.

between the periapical infection and the peridental infection, the operation by means of the now prevailing method of incision will not reach at all the peridental infection.

It is conceded by the best men who have entered infected periapical regions that the only way to completely eradicate such infections, is to remove all that



Fig. 4.—Section taken from *A*, Fig. 3, for high magnification. (X 120.)

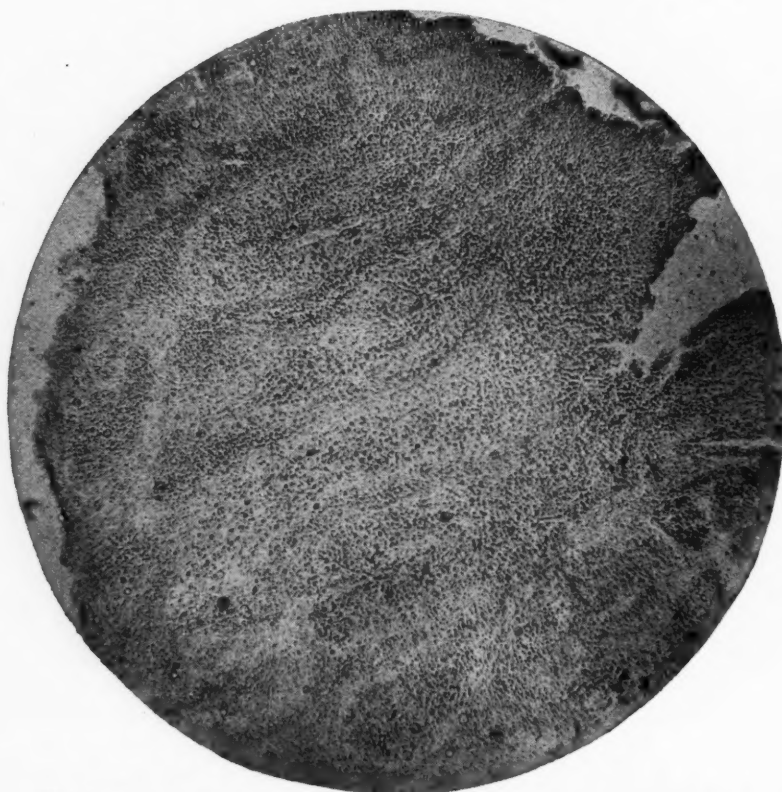


Fig. 5.—Section taken from *B*, Fig. 3, for high magnification. (X 120.)

portion of the apical end (after the root-canal of the tooth has been very recently correctly filled) which rested in the infected area and to thoroughly curette the parts, so as to leave a fresh surface of healthy bone surrounding the amputated root. If any of the granulomatous tissue found in these regions were allowed to remain behind, or if any of the bone surrounding the infected area were allowed to remain in place without thoroughly curetting the surface coming in contact with the infection, until the familiar feel of healthy bone is noticed, the operation would not be a success and sooner or later periapical reinfection would take place. There is no reason why if reinfection takes place in this region for the above mentioned cause, it should not be the same in other

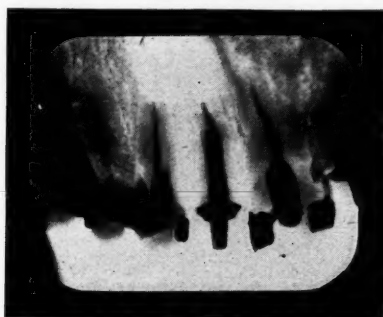


Fig. 6.—Case of periapical and peridental infection, Fig. 7.—Same as Fig. 6, immediately after combined operation.

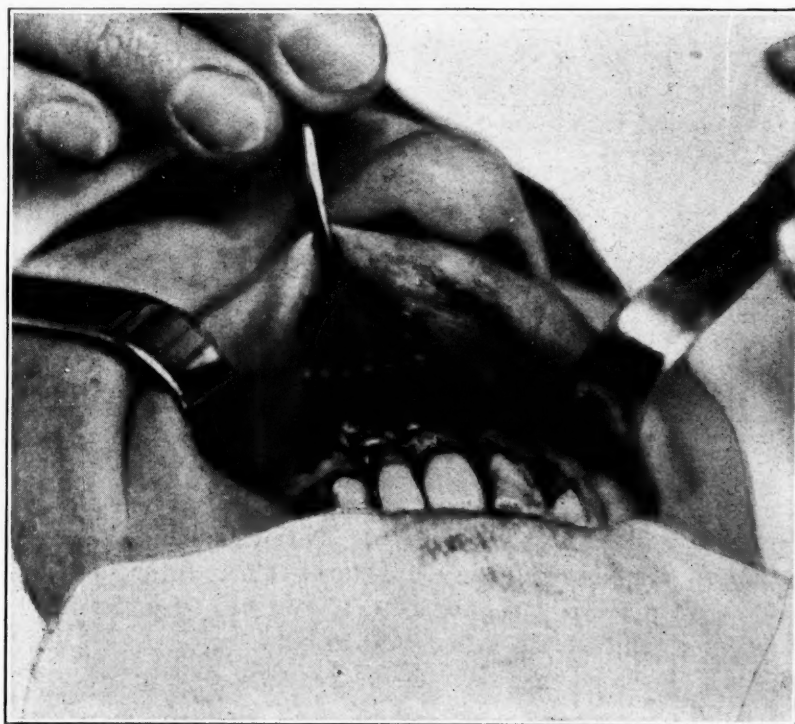


Fig. 8.

regions surrounding the teeth and their roots, if a similar condition and cause should prevail.

Where there is periodontal infection, there is granulomatous tissue (Fig. 1, *A*) proved by pathologic examination (Fig. 3, *A* and *B*, Fig. 4, Fig. 5) to be of the same character as the granulomatous tissue (Fig. 1, *B*) found in periapical infection.* Suppurative subgingival pockets forming around the granulomatous tissue, retaining the pyogenic products, progressively reinfect and destroy the alveolar bone surrounding the granulomatous tissue. Undoubtedly, therefore, un-

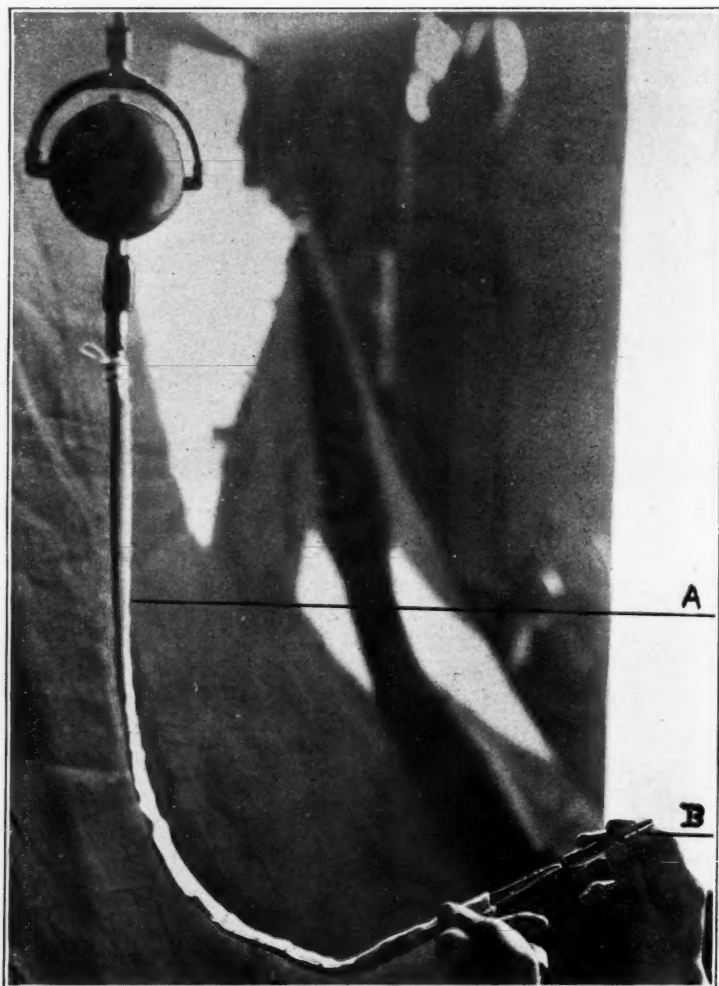


Fig. 9.—*A*, Author's linen sleeve for table; *B*, Dr. Marco's metal slip-on sleeve for handpiece.

less the same principle of thoroughness is exercised in completely removing all the involved soft and hard tissue and unless the subgingival denuded surfaces of the root are thoroughly freed of such irritants as may be present, and curetted, there is nothing to expect but recurrence of the periodontal infection.

In order to obtain unobstructed access to both the periapical and periodontal infected regions (Fig. 6) at the same time, so as to be able to execute the needed

*Report of National Pathological Laboratory of tissue from Fig. 1, *A* and *B*: "Both pieces same type of tissue and show solid infiltration with lymphoid cells and polymorphonuclear leucocytes."

steps for a thorough combined operation (Fig. 7) for peridental and periapical infection, after preparing the patient as for all oral surgical operations under novocain-suprarenin conductive anesthesia, two vertical parallel incisions are made either side of the tooth or teeth involved, starting at the cervical free border of the gum and carrying them *beyond* the apical region. A periosteal flap is lifted, retracted and held in place by the assistant (Fig. 8).

The periapical area of infection is easily reached, if the overlying alveolar bone is destroyed by disease, without the use of the chisel and mallet. If the overlying infected area is covered by healthy hard bone, this is chiseled away and after the apical end of the root is freed of surrounding bone, it is removed with a chisel and mallet if the tooth is fairly solid in its alveolus. If the tooth is loose and the looser the tooth, the more the use of the surgical burr in the en-

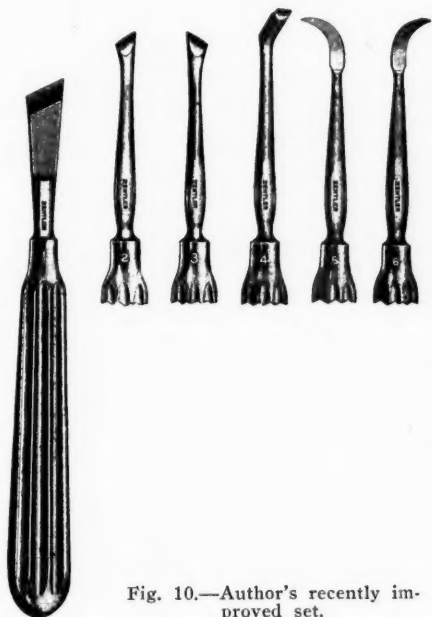


Fig. 10.—Author's recently improved set.

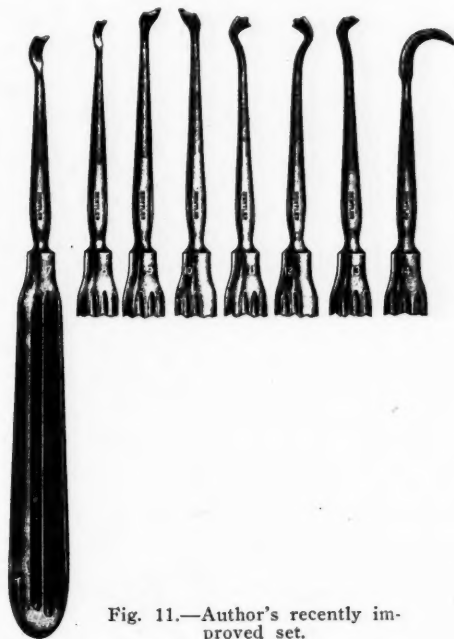


Fig. 11.—Author's recently improved set.

gine is preferred to the chisel for the severing of the apex. Whenever an engine is used for surgical operations in the mouth, the cable engine is advantageous because of the possibility of covering the cable from one end to the other with a sterile linen sleeve (Fig. 9, *A*) designed for this purpose and being one inch in diameter and about 33 to 34 inches in length. The handpiece being covered with a metal slip-on sleeve (Fig. 9, *B*), designed by Dr. Marco, which can be easily sterilized through boiling.

When the chisel and mallet are used for the operation, a round wide-bladed surgical burr may be used to smoothen the amputated root-end as well as any sharp edges of the surrounding bone. A normal saline solution is used to wash away any shavings resulting from the use of the burr.

When assurance is had that the periapical infection is thoroughly accounted for, a sterile small gauze sponge is placed lightly in the periapical space and attention is directed to the peridental infection.

The technic of operating for this was formerly described and published* in detail, and only the more pertinent parts of it are here repeated: The diseased part being well exposed, with suitably, specially designed knives and cu-

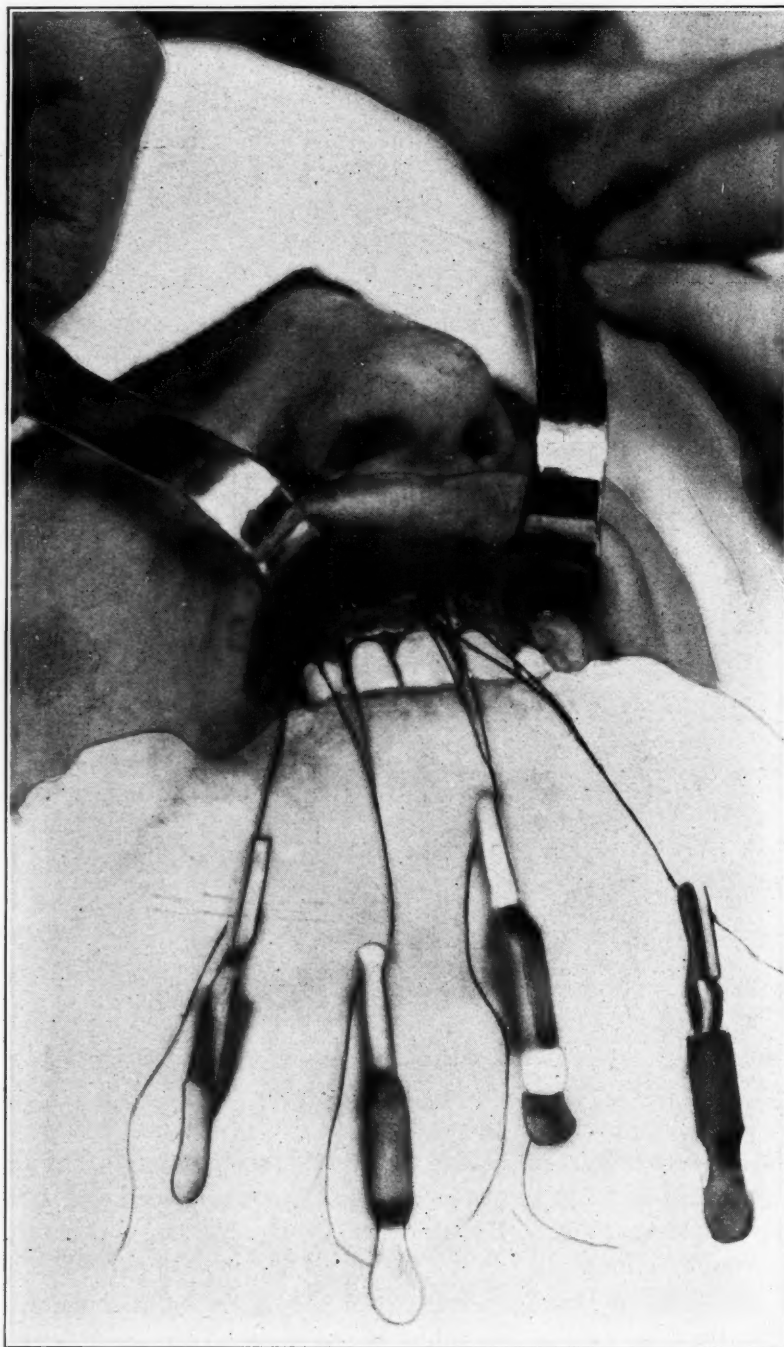


Fig. 12.

rettes, the shapes of which have recently been somewhat modified (Figs. 10 and 11), all the inflamed, infected, granulomatous tissue found between and sur-

**Jour. Am. Med. Assn.*, Nov. 9, 1918, p. 1530; also *Dental Items of Interest*, March, 1919, p. 175.

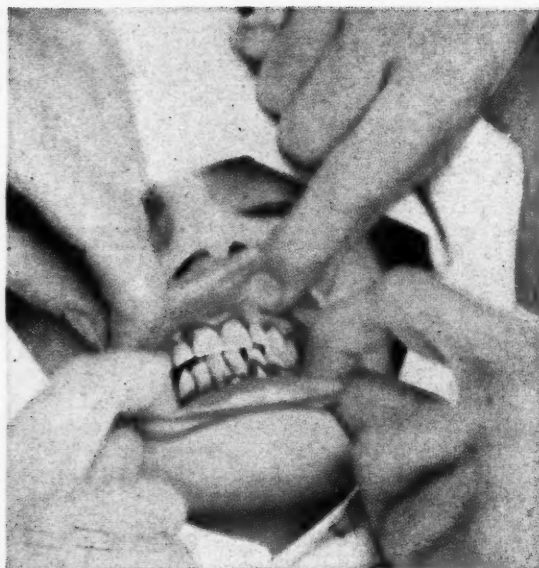


PLATE I

Same case as Fig. 15. Reproduced from slide obtained by Lumiere process
in 1917 shortly before operating as described in Fig. 15.

rounding the roots of the teeth is removed. Next, with delicate chisels and mallet, the alveolar plate is chiseled away from around the denuded portions of the roots, so as to insure the removal of any and all infected bone covering the roots, which are then well curetted. The rough edges of the remaining alveolar bone covering the roots are well smoothed so as to form an even surface with them.

It will be often found upon the inner portion of the flap, as well as in the periapical infected region, if the bone has been destroyed by disease, as in the



Fig. 13.

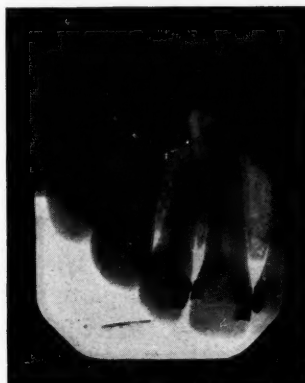


Fig. 14.—Same case as Fig. 13 seven months after root canal filling and combined operation.

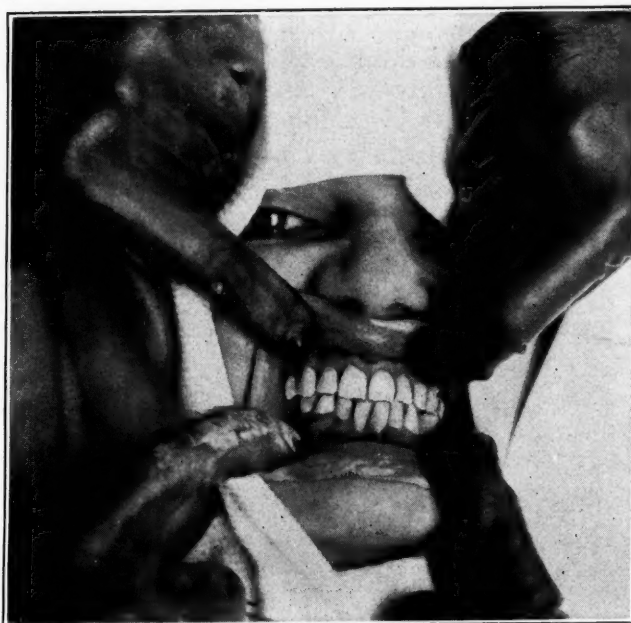


Fig. 15.—Photographed May, 1919. Case operated by lifting flap over entire upper anterior region, in 1917; lower anterior region operated by the modified excision method (see page 5, *Dental Items of Interest*, March, 1919).

peridental infected region that portions of pathological (granulomatous) tissue adhere to the subperiosteal surface of the flap when this is lifted. All such pathological tissue whether in the portion overlying the periapical region or

elsewhere on the flap, must be carefully dissected away, leaving no diseased tissue adhering to it before replacing it in position. Before doing this, the gauze sponge placed in the periapical cavity is removed, the entire area operated upon is swabbed with a 50 per cent solution of the official tincture of iodine, and the wound surface freshened up. The flap is finally sutured (Fig. 12). This is followed by the usual instructions to the patient, and postoperative care given any other oral surgical operation.

Wherever the periapical and the peridental infection are so advanced that they are continued into each other to such an extent that most all of the investing tissue surrounding the apex and other surfaces of the root is lacking (Fig. 13), the combined operation as above described, if at all performed, instead of removing the tooth, may be done only as an experiment.

Such cases were operated by the author, experimentally, and terminated successfully in a sufficient number of cases to make the effort worth while. (Fig. 14).

The complete reattachment of the gingival flap, firmly embracing the root of the tooth at such portions (cervix or higher) where it was replaced in cases operated (Fig. 15 and Plate I) fully disposes of probably the only objection which may be raised (by such who have not seen the results of the operation), namely, the fear that severing the attachment of the gingiva at its free border, in such parts where disease has not already accomplished it, may mean a permanent injury to the part.

If the operation is performed with the care and thoroughness essential to all surgical operations upon infected areas, there will be, in time, such perfect gingival reattachment, that even the finest probe can not be passed.

DEPARTMENT OF DENTAL AND ORAL RADIOGRAPHY

Under the Editorial Supervision of

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It is the object of this department to publish each month original articles on dental and oral radiography. The editors earnestly request the cooperation of the profession and will gladly consider for publication papers on this subject of interest to the dental profession. Articles with illustrations especially solicited.

DENTAL RADIOLOGY AND OBSCURE INFECTIONS*

BY FRED S. O'HARA, M.D., LIEUT.-COL., M. R. C.
SPRINGFIELD, ILLINOIS

OF exceeding importance was the position of the liaison-officer "over there." Over here, the connecting link between the physician and the dentist is analogous to that of the officer just mentioned and is filled only by the rentgenologist.

In those good old days (now visible only through the dust that we have raised by our high-powered thinking-apparatus as it sped down the highway of years-), "rheumatiz" and "neuralgy" were carefully and patiently treated, through years of time, with powder, pill, and potion. "Yarbs" were brewed *ad nauseam*; porous-plaster emporiums worked overtime, to fill the demand; and wintergreen-trees sobbed away their innocent lives in the knowledge that they would be early called upon to fill the emptiness in the gaultheria-receptacles.

The doctor that could introduce the greatest number of ingredients in one bottleful of dope was the commander in the antirheumatic phalanx, and all sought that famous prescription wherein could be tasted everything from stewed onions to broiled rubber sheeting. Children had seven kinds of hell whipped out of them to cure the "growing-pains," under the impression, evidently, that counter-irritation was worth its weight in porter-house steaks.

A PROPHECY OF A NEW ORDER

Strange to relate, when grandma bade farewell to the last of her snaggy teeth and assumed the role of chief engineer to a full complement of artificial teeth, her "rheumatiz" left her, she improved in condition; in fact, gained in weight and strength to such extent that she once more could bring in the coal and the kindling.

*Reprinted with additions from the Am. Jour. of Clin. Med., August, 1919, xxvi, No. 8.

When the maid of all work visited the dentist because of toothache, she came home spitting blood, but, that was all. One by one, the decayed teeth left their moorings, and her smile became that of the family-watchdog through a picket fence. Later on, she made the final visit to the dentist and shed the remainder of her grinders; appearing soon after with a temporary plate which, in turn (after the bone had filled in), yielded place to a permanent artificial denture. Then all her troubles were over, unless she married the town-sot or tied up with a four-plus Wassermann clad in trousers or a walking representative of Neisser's favorite plaything.



Fig. 1.—This "nervous" woman has an abscess in a tooth with a gold filling. Nerve died as a result to the "pecking" of the gold foil into the tooth.

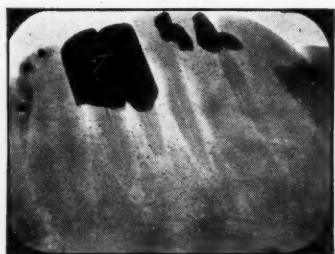


Fig. 2.—A not unusual aftermath to "crowns."

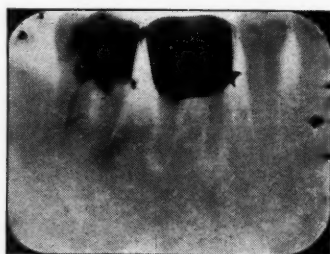


Fig. 3.—From the same patient as Fig. 2.

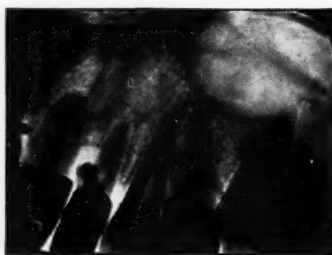


Fig. 4.—Rheumatism.

This little attempt at levity brings us to facts, hard, iron facts: Each year brings a new fad in medicine (and dentistry). Sometimes a thing to be promptly discarded, after having been tried in the balance, and at other times a something that shows a rift in the clouds that obscure the *ultima Thule* of medical and dental ambition.

My earliest recollection of dentistry was the rule to extract any tooth that ached. My father was an excellent dentist, yet, despite my early training along dental lines, I hopped the dividing fence and cast my lot with the medical fraternity; "not, that I loved Cæsar less, but, that I loved Rome more." I well remember the lame, the halt, and the (almost) blind coming into my father's office and departing, minus a multitude of snags and roots. I have seen the same patients come back for artificial teeth, improved in appearance and having gained in weight, despite the fact that, during the interim, they had been upon a soft diet that could be disposed of by unarmed gums. And, with subsequent mastery of the art of mastication by means of artificial teeth, said patients bloomed afresh into ruddy health. Why?

ABSCESSED TEETH, AND CHRONIC AILMENTS

Far too lengthy for the contribution that I purpose to limit to less than a folio would be the discussion of body-infections from decayed (abscessed) teeth.



Fig. 5.—Note the anterior "abutment" for the bridge. Probably one hundred dollars wasted besides the danger from absorption.



Fig. 6.—Same as Fig. 5.



Fig. 7.—This bicuspid shows no cavity nor decay. Yet it is abscessed and its possessor was "rheumatic."



Fig. 8.—He "kicked" because the dentist would not work upon the teeth without an x-film. Note the enormous abscess.

Consider the decay that causes an inflamed and, later, a dead and decaying nerve; and, owing to the plug of foodstuffs that effectually blocks all drainage through the crown of the tooth, the pus finds outlet through the apex of the root of the tooth, and there, in the spongy bone, it thrives and founds a numberless family, which may show a danger-signal by a "gum-boil," but, not infrequently, exhibits

itself in the form of arthritis, appendicitis, endo- or pericarditis, cholecystitis and many other forms of "itis." That such things have happened even the most conservative will admit.

And now comes the danger line. Let him that is without error among you cast the first stone. It is here that sages will disagree. Shall the dentist endeavor to sterilize the root and save the tooth or, should the tooth be extracted at once? *Quien Sabe?*

So, we must endeavor to penetrate further into the mysteries of the apex and the apical abscess. The radical dentist, by means of microscope slides, shows that the abscessed cavity never heals completely; that a tooth in which the nerves are dead is a foreign body in the alveoli and should be removed, as becomes a foreign body. The ultraconservative dentist assures us that "thousands of these teeth have given no trouble and that crown- and bridge-work are far better than clacking porcelain."

But, while I have your undivided attention, I will state that even the ultra-conservative dentist, when ordering dental x-ray work, invariably (unless all



Fig. 9.—Diagnosed MUMPS but swelling persisted. Patient came to me for x-ray of HEAD. I first examined teeth and found the trouble without raying skull.



Fig. 10.—Rheumatism.

teeth are to be rayed) calls attention to all crowns and bridge abutments, and desires that they be given careful attention. And there begin the troubles of the rentgen-ray specialist.

UNCERTAINTIES OF INTERPRETATION OF SKIAGRAMS

How can I prove that there is an active abscess under a given tooth? The answer is delightfully short. "I CAN'T"—that is, without the assistance of a few questions and some common sense. Unfortunately, the necromancer that works the jigger that makes the x-rays come out of the little opening is supposed to be many things that he *is NOT*. Among these things, are the roles of fortune-teller and prophet of the future. *But*—given a case wherein a "gum-boil" has caused the patient to seek dental consolation and said dentist sending the subject for a skiagram and then, when the film has been introduced into the mouth, back of the "gum-boil," showing an apical abscess; this, plus a history that the tooth "feels longer than the rest," is a fair indication of active trouble.

Were one of the readers to sit upon a 12-inch high-explosive shell and peck at the percussion-end until the shell exploded, he, too, would be convinced that the shell was active.

A man can ponder at the edge of a shell-hole and say, "A shell exploded there." If grass is growing in the cavity, he can be reasonably sure that the explosion was not a recent one. But in any event, he can not be sure that there are no fragments of shell left buried in the crater." So with the tooth abscess. Maybe it is ancient, perhaps fairly recent, but, we have not the knowledge whether or not the justly famous *Streptococcus viridans* has occupied apartments in the alveoli. Most of the investigations show that Mr. and Mrs. S. Viridans are there and at home all the time.

Hence, we have a camp of physicians and dentists that say: "If it aches, have it out; if it has ached, have it out." And, we can not give a much safer answer.

It were useless for me to describe a rheumatic wrist in full bloom subsiding coincidentally with the removal of an abscessed cuspid tooth. Please, take my word for it. It were supererogation for me to state that, in all the years that I have been radiographing teeth, I never have failed to find apical abscesses in every case of "rheumatism" brought me for skiagrams of the teeth.

Let us agree that far too much is expected immediately after the removal of teeth found guilty. Were the sockets curetted or did the dentist allow the involved area to be sealed in by process of nature? In extreme instances, the deposit of the "deformans" is so great that it never can be wholly resorbed. This is our misfortune rather than our fault. The percentage of recoveries is high, much higher than before the "take the picture of my teeth" became the slogan of our rheumatics.

In these days of progress, when our advance-guards are so close upon the haunches of the enemy that our guards can count the hobnails upon said enemy's shoes, a mistake in diagnosis may be the cause of failure when dental films are called to account. I have seen a neuritis (following the influenza of recent months) so simulating the old and familiar sciatica that the first thought was, to radiograph the teeth of the sufferer. But, when he took them into his hands and passed them to the doctor, with a friendly "Go as far as you like, but, do not break them," the doctor wisely began to search for other possible avenues of infection.

ALWAYS HAVE THE TEETH RADIOGRAPHED

It is possible to theorize until the bottomless pit is transformed into a skating-park and yet not reach facts. As I see the rift of light through the clouds it reads like this: "the teeth are responsible for a multitude of ailments. It is never supererogation to have them examined, although, many times, the seat of trouble will be found elsewhere."

Do not expect everything of your dentist. He will help wonderfully; still, he is not infallible. The work of dental radiography is new, so new that we do not fully comprehend everything that we see upon the plates.

In interpreting films, two things are misleading. The anterior palatine canal, if the angle of raying is not perfect, may simulate an abscess under either of the upper central teeth. Also, the shadow of the inferior mental foramen may cause like confusion, by overlying a bicuspid.

Make friends with the rentgenologist, and do not be superior to asking him

for his opinion and interpretation. (Note kindly, that I am not speaking of the mechanical "laboratory-man," who is only a technician and who is without medical education.) The rentgenologist sees hundreds of films where you see one. "Practice makes perfect."

In conclusion, just think back to the days when artificial teeth were the rule, and go over those cases that were rheumatic, and try to recall the condition of the teeth in such cases. Mouths full of snags? Surely! How well you remember the Roquefort-cheese breath and the tongue that required an acid bath to tell whether it was coated or plated. Yet some of the advanced thinkers of those days smelled the mouse that we have visualized, but, most of them thought that the bacteria of decay were ground into the food and hence, affected the digestive organs alone. They did not dream that mastication was pumping a myriad of germs from the apices of the teeth into the blood-stream.

EMPIRICISM AHEAD OF SCIENCE

I well remember my father (a dentist), twenty years ago, refusing to install bridgework; offering as his reason the conviction that bridgework was unsanitary, citing his experiences in removing bridges and extracting the "abutments," with a notable improvement in the health of the patients. Bringing the theme down to date, recently, a dentist in discussing the matter with me, remarked: "Your dad was twenty years ahead of his time. How we laughed at his cranky ideas then, but, we know now that he was right."

Readers, most of you will see the disappearance of bridgework and the final obsequies of the porcelain and gold crowns mounted upon dead teeth.

Prophylaxis? Surely! Write this in letters of fire. "DON'T LET YOUR TEETH ACHE." Give the same advice to your patients.

Each day brings me fuller conviction that a new era in dentistry and medicine is at hand. In ten years the extremely delicate art of angling for dead nerves will become about as popular as a case of measles in a baby ward. Those dentists who have bent and broken under the nerve-wrecking strain of root canal work will become relics of the past.

Grandma and mamma, having suffered hundreds of dollars worth of jewelry to be ripped from their mouths, will see to it that the rising generation "have their teeth tended to before they ache," and the world will have advanced another peg toward perfection.

ABSTRACT OF CURRENT LITERATURE

Covering Such Subjects as

ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA — DENTAL RADIOGRAPHY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

The Etiology of Mutism in War-Wounds. A. Chiavaro. *Annali di Odontologia*, 1919, iv, No. 1, p. 11.

Mutism is sometimes associated with lesions of the maxillary bones, and accordingly acquires an odontological interest. The majority of the cases of mutism published in the course of the war have been defined as cases of psychic hysterical mutism, because the mutism was not apparently associated with any lesion sufficient to explain it. The mode of recovery seems to indicate the hysterical character of the mutism, for after a more or less prolonged period of total silence, the patients usually speak under the influence of a violent emotion, frequently after awakening from chloroform or ether anesthesia given for the performance of some surgical operation. This fact was known long before this war and was mentioned by Hutchinson in 1820 in the report of a clinical case. A few cases of mutism in soldiers with maxillary wounds came under observation in the principal military hospital in Rome, and were at first diagnosed as cases of hysterical mutism. On more careful observation, however, it could be shown that in several of these cases the etiology of the mutism was referable to anatomical lesions, after the cure of which the patients regained the power of speech. A very instructive case of this kind concerned a soldier of 25 years who was wounded by a gunshot projectile, with the entrance orifice in the right zygomatic region and the exit orifice behind the maxillary angle on the left side. In its course the projectile had produced severe lacerations of the palate, and after penetrating into the buccal cavity had knocked out several teeth, it then passed through the left wall of the pharynx, very close to the nerves and blood-vessels, without damaging the carotids. The patient could pronounce only a single sound: Ah! but in spite of all efforts was unable to speak a word. When admitted to the hospital, he was suffering from sinus suppuration of traumatic origin, for which he was operated upon under chloroform anesthesia. He remained voiceless after awakening, but six days later he began to speak and gradually reacquired the normal power of speech. Another soldier, who was admitted with maxillary fracture, suffered besides from hysterical deaf mutism. Three months previously, he had been wounded by a gunshot projectile which entered on the left side of the chin at the level of the buccal angle, corresponding

to the first upper molar; the bullet had pressed through the alveolar portion of the mandible, fracturing three teeth on the left lower side; next, it passed through the floor of the mouth, emerging on the right side of the neck at the anterior border of the sternocleidomastoid, at the level of half the mass of the thyroid. This case had likewise been interpreted as psychic-hysterical deaf mutism, but observation served to show that the deaf mutism was actually due to the above-described lesions which affected the ears, and to the existing paralysis of the right half of the tongue and the floor of the mouth on the same side. As these pathologic conditions improved, the patient began to articulate a few words and later on regained the power of speech.

Mutism can not, of course, be claimed to have only one pathogenesis, whether it manifests itself as the only pathologic expression following a severe nervous shock, or whether it appears as a complication of other lesions. Without denying the possibility of a purely psychic-hysterical form of functional mutism, the author believes that the pathogeneses of many cases of mutism are referable to other causes. A severe nervous shock, and traumatism in other cases, may produce a passive congestion of the vessels which supply the cortical center, consequently determining the functional arrest of this center, which governs the motor function of speech. This functional arrest will subside spontaneously after a short time, unless the cause which has produced it continues to act, which is presumably true in many cases of obstinate mutism. Etherization, which produces in the first place a marked stimulation and considerable hyperemia of the meningeal vessels of the cortical region, and in the second place a decongestion efficiently assists the re-establishment of the normal circulation, thereby favoring the recovery of the psychic-motor function.

Fistula of the Parotid in War Wounds of the Face and Jaws, with a Note on Radium Treatment. Percival P. Cole and R. Knox. *The Lancet*, London, 1919, i, p. 971.

Fistula of the parotid gland or its duct is a relatively rare complication of facial wounds. Whereas gland fistulae and incomplete fistulae of the duct when healing is delayed always readily respond to the application of radium on x-rays, complete fistula of the duct is incurable except by operative methods, in the form of seton operations, atrophy operations, and reparative operations. Section operations are usually unsuccessful and are mentioned only to be condemned. Atrophy operations, which aim at inhibiting secretion by cutting off the secretory nerve-impulses to the gland, are likewise undesirable. A reconstructive procedure was adopted by one of the authors (Cole) with very favorable results, in two cases in both of which several previous attempts had been made to reestablish communication with the mouth by seton methods, the only result being to diminish plasticity by the increase of scar tissue, and so add new difficulties to those already existing.

Technic of Radium Exposures for Parotid Fistula: The treatment in all the cases dealt with—sixteen in number, was the same, namely, exposures to a penetrating radiation from 200 mg. of radium contained in platinum tubes of a

thickness of about $\frac{1}{2}$ mm.; in addition, 3 mm. of lead were employed to cut off all or nearly all of the hard beta radiation and allow of the gamma radiation being used. The radium tubes were enclosed in rubber tubing and in addition several layers of lint were used on the skin to cut off any secondary radiations from the metal filters. An exposure of three to four hours was given to each skin area. In one case each area received six hours' exposure. The variation in the time factor was estimated on the condition of the tissue in each case, those with considerable induration of tissue receiving longer exposures than the others. No marked reaction was obtained in any of the cases treated. In a number of patients, x-rays were combined with the radium treatment, small doses being given at short intervals; the x-rays were filtered through 2 mm. of aluminum.

Bilateral Temporo-Maxillary Ankylosis Successfully Treated by Operation.

L. Arago, II Policlinico, 1919, vii, No. 71.

The author describes the technic of his original procedure of simple resection of the ascending ramus and the articulation employed by him in a case of temporo-maxillary ankylosis with complete trismus in a young man of twenty years. The condition had followed an attack of parotid inflammation after small-pox. A horizontal incision is applied along the zygomatic arch, and the bone is then very closely scraped, under detachment of the masseter, thus reliably avoiding the facial nerve, the blood vessels, and Steno's duct. The ascending branch is then divided, tangential to the border of the sigmoid notch; next, the condyle is resected and the coronoid process is turned down with the forceps. In this way a pseudarthrosis is obtained which permits the normal motion of the mouth, and especially a good articulation of the teeth. The operator expresses himself as very well satisfied with the results of this simple operation, which is nonmutilating and can be easily performed under local anesthesia. To circumvent the difficulties resulting from the unequal level of the skin and bone section, an electric drill is utilized. A linear series of orifices is applied and subsequently united with an instrument, so that the ascending branch is promptly divided. From the tenth to fifteenth day following the operation, the supplementary mechanical treatment may be instituted.

Report of a Case of Emphysema. L. N. Diaz. *The Dental Cosmos*, 1919, lxi, No. 8, p. 781.

The patient was a young man sixteen years of age, with a second right upper bicuspid which had to be devitalized. The usual procedure was followed, *i.e.*, an application of arsenic for removal of the pulp. The canal was found to be quite large, as is usually the case with young persons, the foramen also being found to be above normal size. Just before scaling the canal, as the final step, the operator proceeded to dry out the canal with a hot-air syringe, the air compressor registering fifteen pounds. The operator was so taken up with the operation that he did not see a gradual swelling of the tissues on that side of the face, until the patient called his attention to it. The patient was by this time gesticulat-

ing and giving all signs of a man in distress. The swelling was strictly unilateral, much enlargement showing under the eye and over the whole cheek, giving all indications of being intramuscular rather than subcutaneous. As the air did not appear to escape through the canal, the tooth was sealed with gutta-percha and the patient sent home, the operator reassuring him by stating there was nothing amiss in that peculiar condition, and telling him to return on the following day. When the patient returned the swelling had subsided to a great extent. On the third day everything was found to be normal, whereupon the canal was filled, and up to the present day it has not given sign of any abnormality.

Fracture of the Mandible in the Vicinity of the Angle. R. V. Hennessy.
The Medical Journal of Australia, 1919, ii, No. 5, p. 88.

The author was enabled to observe a peculiar case of double fracture of the mandible, the result of traumatism, in a young woman 23 years of age. The skiagrams showed in addition to fracture at the angle of the bone on either side, the presence of an unerupted third molar tooth which on the left side at least was definitely impacted. It was decided that the best way to treat this fracture would be to immobilize the temporomandibular articulations by wiring the teeth of the island fragment of the mandible to those of the maxilla in correct dental occlusion. Angle's heaviest gauge orthodontic wires were used. One wire was passed around one of the bicusps and the canine tooth in both jaws on either side, eight teeth in all being used. The tails of the wires were left long and were intertwined with those of the corresponding teeth of the opposite jaw, thus effecting a permanent fixation of the lower teeth to the upper. The anchorage thus obtained was not sufficiently strong to withstand the strain for longer than one week. Altogether until they were finally removed, the wires were renewed three times, this covered a period of about three weeks. By this time the union had become sufficiently strong to give rigidity to the jaw for movement and mastication. Three months later, when the patient was last seen, there was a firm union on both sides and no callus was perceptible to the examining finger. The facial symmetry was undisturbed. The bite was not exactly the same as before the fracture; there was a very slight inferior protrusion. Nevertheless the patient was able to masticate with ease and the new bite caused little or no inconvenience. During treatment of such cases, the oral hygiene is easy to maintain and a tooth brush with peroxide is used vigorously and frequently. A spray is useful in the early stages.

Tuberculosis of the Inferior Maxilla. Aimes and Aubanel. *Le Progres Medical*, 1919, xxx, p. 291.

This bony localization of tuberculosis represents a rare variety of the disease. The lower jaw is not equally susceptible in its entire extent, the alveolar portion and the region of the angle being most frequently affected. A distinc-

tion is therefore made between two anatomical forms, the alveolar and the central, although the latter may also become localized at a distance from its site of election at the angle, involving the ascending ramus, for example. Tuberculosis of the lower jaw is a disease of childhood and youth, affecting both sexes equally and manifesting itself in patients who are already infected and present other tuberculous lesions. The maxillary localization in these cases is secondary, the infection occurring through the blood vessels and lymphatics. In other cases, the involvement of the jaw follows upon a lesion in the vicinity, such as periostitis or ulceration of the gums due to the tubercle bacillus. Finally, tuberculosis may become superadded to a pre-existing nontuberculous inflammation, such as osteomyelitis, gingivitis, or simple periodontitis. Manifest or latent tuberculosis usually exists in all these cases of secondary localization, as in the author's little patient. Primary forms, however, do occur, in which the affection of the maxilla is the first demonstrable manifestation of tuberculosis. The avenue of entrance in these cases is represented by a surface infection of the lung, a skin abrasion, or penetration of the bacillus through the intestinal mucosa. After a latent stage during which the germs travel through the blood vessels or lymphatics, they lodge and manifest themselves at the level of the maxilla, the circulatory system accordingly constituting the route of propagation. As the cause which determines the arrest of the bacillus at this point, traumatism or dental extractions have been held responsible, but the origin usually remains obscure. The first symptom is bony swelling, also involving the soft parts, at the level of the cheek, but usually without a change in color of the tissue surfaces. The swelling in this stage is hard, nonfluctuating, accompanied by a dull pain, spontaneous and on pressure. Gradually the swelling extends, increases in volume, and becomes locally softened. The pain becomes more severe, functional disturbances supervene, and mastication is interfered with; the cervical glands participate in the process, and the resulting adenitis may in its turn lead to suppuration. In the final stage, an abscess forms, fluctuation is established, the superficial tissues ulcerate, and a fistula appears, external and opening on the cheek in case of localization at the level of the internal angle; intra-buccal, when the alveolar margin is affected. The fistula leads either to the bone itself, or to a sequestrum, but this is not invariably the case. The above-described course is slow and requires several months or even years to arrive at its ultimate stage. The process is essentially local, and unless complications occur, the general symptoms remain insignificant, for example a slight rise of temperature at night. The symptomatology of the ordinary type is the same as in all bony tuberculoses, but acute forms of osteomyelitic type also occur, with a sudden onset and a rapid course, accompanied by redness and heat of the tissues, and associated with very marked general phenomena, such as a high fever, acute pains, headache, and prostration. Intermediate forms between these two extreme types are sometimes noted, as in a case under the author's personal observation. The patient, a boy eight years of age, presented a large abscess over the lower jaw, on the left cheek, extremely painful and adherent by a broad base to the inferior maxillary angle. Radiography showed a considerable thickening of the entire left lower jaw, with a zone of bony rarefaction; the thickening was especially marked at the horizontal ramus, in the vicinity of the maxillary angle.

Amputation Neuroma of the Lower Jaw. F. Bruning. (*Centralblatt für Chirurgie*, 1918, No. 40, p. 713.) *Correspondenz Blatt für Schweizer Aerzte*, 1919, xlix, No. 31, p. 1186.

In a case of extensive shattering of the lower jaw through a gunshot projectile, the cause of the severe pains which persisted for a long time consisted in a typical amputation neuroma of the mandibular nerve. Removal of the neuroma by means of avulsion was followed by complete recovery. Cases have been observed in which the terminal cicatrix presented an enormous number of nerve fibers (nonmedullated) several years after the operation. An extremely profuse regenerative reaction of the nerves may occur even after a very prolonged functional rest of the nervous fragments. In this instance, the ends of the ruptured nerve were well protected by the bony canal, and the gradually extending axis cylinders at first encountered no resistance, until later on they met with scar-tissue, with the result that their growth became intermingled and a neuroma was formed. The patient had lost the entire anterior portion of the lower jaw through the gunshot wound, and at the time of admission to the Military Hospital in Constantinople presented the following picture: The anterior portion of the inferior maxilla was missing on both sides as far as the first molar. The soft parts were for the most part preserved, with considerable cicatricial contractures, whereas the bone was completely lost. Numerous fistulas, discharging pus and mucus, were seen over the two bone-stumps, in the external skin, as well as towards the mouth. Recovery followed after exposure of the bone-stumps and removal of sequestra from both sides. A well marked tenderness of the right bone-stump persisted, the cause of which was not discovered in repeated examinations. The external and internal cicatrices were free from irritation, and no inflammatory manifestations existed in the surroundings. There were no remnants of roots, and no sequestra were revealed by radiography. Under the assumption of periostitis, the treatment consisted of hot compresses from the outside and application of iodine tincture to the surrounding buccal mucosa. Some improvement was obtained, but the severe pains still persisted and required treatment. Keeping in mind the possibility of adhesions of the mandibular nerve to the cicatrix, the author did not feel justified in excluding the presence of a causative sequestrum, not shown in the radiogram. The maxillary stump was accordingly exposed in another operation. Neither inflammatory phenomena nor sequestra were found, but the mandibular nerve presented a typical small amputation neuroma. The nerve projected only slightly from its bone-channel and terminated in a spherical dilatation nearly the size of a pea. Only slight adhesions with the cicatrix were present. The neuroma had developed in the bony canal which extended for a short distance as a partial canal minus the external wall. The nerve was removed by avulsion, and the patient made a good recovery.

Osteomyelitis of the Mandible Due to Apical Dental Necrosis. B. De Vecchis. *La Riforma Medica*, xxxv, No. 22, p. 439.

Attention is called to this pathologic manifestation, not on account of the difficulty of the diagnosis and differential diagnosis, but on account of the im-

portance of its origin, on which intelligent and helpful treatment may be based. Two typical cases of mandibular osteomyelitis recently came under the author's observation, which, although of similar onset, differed in their course, their clinical features, and also as to the prognosis. The first patient, a strong and healthy soldier, 34 years of age, was kicked by a horse in the region of the chin and suffered deep lesions down to the bony layer, the symptoms gradually subsiding. Examination three months later showed the existence of some swelling, especially in the central portion of the chin, and three small fistular openings with a cicatrized floor. On deep palpation, which was extremely painful, a few drops of creamy yellow pus escaped from the fistulous tracts, these converged towards a point near the median incisors, where a small sequestrum was encountered. Radiography showed small areas of absorption about the genial process and some tracts of hyperostosis and inflammatory thickening of the bone. The dental apex of the right median incisor seemed to be entirely absorbed. The diagnosis was subacute focal osteomyelitis with fistula-formation. The prognosis was anatomic and functional cure within one month. The treatment was operative and consisted in extraction of the incisor, scraping of the alveolar floor, and thorough irrigation with hypochlorite solution. The mandibular swelling subsided in a few days, and the fistular tracts which were syringed out daily with the above-mentioned solution, closed about the fifteenth day. The patient left the hospital well, one month after admission.

The second observation concerned a man of 28 years, in bad condition, and suffering from chronic malaria. A swelling of the right half of the face had developed without an apparent cause. A complete examination of the buccal cavity was not possible, as the patient suffered from contraction of the jaws. Two lower molars on the right side were seen to be carious, and pressure on these teeth caused an exacerbation of the pain. The diagnosis was acute phlegmonous osteomyelitis. The prognosis was somewhat guarded, with expectation of a cure in about two months. An incision was applied passing three centimeters from above downwards and slightly backwards in front of the external posterior side of the masseteri; on reaching the periosteum, thick greenish-yellow pus was voided. The wound was drained with gauze soaked in luke-warm Dakin's solution, and hot applications of this solution were applied twice daily. The postoperative course was favorable, the fever diminished and the swelling decreased. Ten days later, the patient could open his mouth, and the second and third molars were removed. He was still in the hospital at the time of the report. According to the anatomic-pathologic report, the cement of the third molar had almost entirely disappeared. The root apices were necrotic. Both these teeth presented penetrating caries with gangrene of the pulp. The author points out that the infection, before becoming externalized through the paradental space, followed the root-canals, the most common avenue especially in youthful individuals, by which infectious germs are carried to the alveolar floor, within the structure of the osseous tissue. The sequestra in mandibular osteomyelitis are represented by necrotic teeth, which although rarely causing deep abscesses, usually give rise to a slow, persistent discharge of pus which may ultimately lead to ulceration of the stomach and other disturbances. Clinical and ana-

tomical recovery is assisted by the complete removal of the sequestrum in the first place, and next by the individual power of resistance of the mouth-cavity.

A Case of Multiple Epulides. W. Warwick James. *The Lancet*, London, 1919, ii, p. 156.

In the remarkable case observed by the author, concerning a girl of eleven years, the growth of a fibrous epulis, in the form of hypertrophy of the fibrous tissue of the gingival mucoperiosteum was associated with each erupted tooth of the temporary and permanent series. The bone was not involved, as shown by radiography. The gingival margins were considerably enlarged and nodular. The tissue particularly involved was apparently the gum margin and the neighboring portion, but not the greater part of that covering the roots. The fibromatous growth had extended round the crowns, in parts even reaching to the top of the teeth. Superficially the growth resembled a simple fibrous epulis, but was not pedunculated. The peculiar mouth condition made its appearance at the age of three years. Pain was absent, but there was some impairment of the general health, probably due to difficulty in chewing. Treatment in the past had consisted in extraction of all the temporary and eight of the permanent teeth, in seven separate operations; complete excision of the growth; and removal of the alveolar margins. Repeated attempts at removal of the abnormal tissue under preservation of the teeth were soon followed by a recurrence of the growth. At the time of the report, the lower canines and the left lower second premolar were involved, as well as the right upper premolar. The author comments that it would be a very drastic procedure to remove every tooth and so render the child edentulous. Meanwhile, the patient has been wearing a vulcanite block to bite upon, and an artificial denture can, of course, be provided if extraction should prove the only resource. The condition in this patient would probably be described as hypertrophy, and although a certain number of cases have been recorded, they are undoubtedly rare. Microscopical examination showed the abnormal tissue to be purely fibromatous.

The Entameba Buccalis in Pharyngology and Rhinology. C. E. Benjamins. *Archivo Italiano di Otologia*, 1919, xxx, p. 100.

The author's rhinologic investigations were preceded by observations concerning the presence of the entameba in the mouth, this demonstration possessing great importance for the rhinologic field. The following method was employed: Some material was removed with an instrument from the gum margins and the crowns of the teeth, even in the best kept teeth, a sufficient quantity of this so-called white matter was obtainable. In various teeth, the contents of the cavity were likewise examined. Two specimens were prepared for each experiment. The investigations covered 122 teeth, healthy or variably diseased, in 116 individuals. The presence of the entameba was demonstrable in altogether 69 cases, and its absence in 53 cases. Dividing the material into cases of pyorrhea alveolaris and teeth free from pyorrhea, the entameba was found to

be present in 35 cases of pyorrhea and in 34 teeth free from pyorrhea; it was absent in 6 cases of pyorrhea and in 47 teeth free from pyorrhea. All writers are agreed that scrupulous care of the teeth exerts an influence on the frequency of amebas in the mouth cavity, and the author in a general way is enabled to confirm these findings, in spite of the occasional occurrence of a large number of amebas in well-kept mouths. The age of the individual plays an important part, the percentage increasing with advancing years. The majority of negative cases are observed in children. In order to judge the results, the age of the examined persons must therefore always be taken into consideration. It is also noteworthy that the chewing of tobacco exerts no influence on the presence or absence of the ameba. Many of the microorganisms were found by the author in the mouths of some individuals who moderately chewed tobacco. In dental caries, the same positive findings were noted as in healthy teeth; hence no causative relation can be established between the presence of the ameba and this dental disease. Conditions are different in pyorrhea alveolaris, where the author like other observers found a large percentage of positive cases. However, this does not prove a causative relation, but at most a certain connection between the pyorrhea and the presence of the ameba, perhaps due to positive chemiotaxis and cooperative auto-disinfection of the mouth. In a general way, the pathogenic action of the entameba on the above-mentioned dental diseases can not be considered as demonstrated by the available findings.

The occurrence of the *Entameba buccalis* outside of the mouth cavity is rather uncommon; this being in part accounted for by the slight mobility of this microorganism. Its penetration into the tonsils can take place mechanically with the saliva. In a number of negative findings in the tonsils, a negative result was likewise noted in the examination of the teeth. The positive results in the tonsils, namely, six times in healthy organs and four times in an about equal number of diseased organs (altogether sixty tonsils were examined), do not support the theory of the pathogenic character of the *Entameba buccalis*. The author accordingly concludes that there exist no pharyngologic or rhinologic reasons for exterminating the ameba.

Vincent's Disease. Glenn L. Pell. *The Dental Summary*, 1919, xxxix, No. 8, p. 615.

This affection, also known as ulcerative gingivitis and trench mouth, is characterized by the formation of ulcers on the gingivæ, buccal mucosa and soft palate, covered by a grayish-white pseudomembrane. On the infected gums, extending from the free margin toward the roots, there is a dark red zone from one to four millimeters in width. Some or all of the teeth may be affected. The condition is aggravated by the presence of tartar, ill-fitting crowns, overhanging fillings, broken-down roots, cavities and inflammatory conditions over and around partially erupted third molars. Constitutional disturbance if present is slight, but severe pain is often complained of. The recognition of this disease is especially important on account of the similarity of the lesions to syphilitic ulcer. The diagnosis is based on the demonstration of Vincent's bacillus and

the spirillum that always accompanies it. The treatment consists in the local application of medicinal methylene-blue or methyl-violet; the success of the remedy depending greatly upon getting the medicament in contact with the organism. The prognosis is very favorable under proper and consistent treatment, as follows: Spray the mouth thoroughly with an antiseptic solution; mechanically remove food debris and sloughed tissue from the gums. Further cleanse with small pledget of cotton, saturated with hydrogen peroxide, followed by antiseptic spray, dry gums, and apply either methylene-blue or methyl-violet with a small pledget of cotton (about the size of a pin head) working it down to the bottom of the ulcerated surfaces. Methyl-violet proved the more potent remedy of the two in the author's experience. The application should be repeated in detail daily as long as necessary, then gradually extending the time between sittings to two, three, four days, or a week, as indicated by the clinical manifestations. All deposits of calculus, overhanging fillings or improperly fitted crowns should be removed as early as possible during the treatment, in order to eliminate the resulting irritation. As a mouth wash, a tablespoonful of a strong solution of potassium permanganate (14 grains in 6 fluid ounces of water) to one-fourth glass of water, should be used every two hours.

The Diagnosis and Treatment of Oral Infections. A. M. Nudine. *The Dental Cosmos*, 1919, lxi, No. 8, p. 726.

Conclusions: 1. The dental profession has been raised to a higher plane by the establishment of the fact that oral infections have a positive effect on the health of the individual. 2. The establishment of this fact is due largely to a more exact diagnosis by the use of the x-ray employed to discover these infections. 3. The public is demanding better dentistry and is placing its confidence in the dentist who employs the x-ray and other diagnostic agents to discover these infections. 4. The dentist should so practice his profession, or employ such methods as will obviate the possibility of the teeth and tissues upon which these methods are practiced becoming foci of infection. 5. When these infections are discovered they must be eradicated in a careful, complete and surgical manner. 6. The present and future health of a patient must be preserved regardless of the fact that teeth may be sacrificed to do so. 7. The prevention of the conditions which make possible these focal infections is the highest form of service a dentist may render. He may be able to restore only in an incomplete functional manner.

Dental Conditions at an Ante-Natal Clinic. J. W. Ballantyne, *British Medical Journal*, 1919, ii, p. 103.

A systematic examination of one hundred consecutive patients in the ante-natal clinic of the Edinburgh Royal Maternity Hospital showed the existence of a deplorable state of affairs: In only two expectant mothers (young women 23 years of age) were all the teeth present in an undecayed condition; all the

other patients had more or less defective teeth. Fifty-six per cent of all these women were 25 years old or less, and half of them were primiparas. Nearly half of the entire number (48 per cent) were wearing false teeth, eight having two plates and thirty-eight a single plate. The existence of this alarming amount of dental deficiency and disease, often concomitant with oral sepsis, can not fail to react injuriously upon the mother's digestion and through it upon the nutrition of her unborn infant. For these and related reasons, the author emphasizes the need of preventive dentistry in young women who may at any time become expectant mothers. A beginning might be made by the temporary appointment of dental physicians to maternity hospitals not already furnished with them. The desirability of greatly increasing the facilities for tooth saving by means of stopping, crowning and the like, is strongly suggested by the study of the cases at the Edinburgh Royal Maternity Hospital. Moreover, the further investigations of these and similar sets of cases at ante-natal clinics may throw some light upon the causation of dental caries in pregnancy.

The Habitat and Distribution of Dangerous Streptococci in the Body.
D. J. Davis, *Illinois Medical Journal*, 1919, xxxvi, No. 3, p. 134.

On the teeth and about the gums are found the *B. fusiformis* and *spirochæta*, on the buccal mucosa and pharynx the *streptococcus viridans* and often varieties of pneumococci. Under certain conditions these organisms may be pathogenic and are therefore dangerous. Potentially dangerous hemolytic streptococci occur in the tonsil crypts in practically 100 per cent, in both normal and abnormal throats. In the mouth and teeth they are practically absent, except when pyorrhea and abscesses occur. On the basis of his investigation, the author arrives at the conclusion that there is normally only one habitat for hemolytic streptococci namely the crypts of the faucial tonsils; from here by surface extension, by contact, and by dissemination of buccal and throat secretions these cocci are distributed to various parts of the body. After tonsillectomy, these streptococci in the throat are much reduced in numbers and frequency. In the small percentage of positives after tonsillectomy their presence may be explained by tonsillar remnants and by chronic infections about the throat, teeth and sinuses.

Some Causes for Periapical Infections with the Pathology. C. J. Grove.
The Journal of the National Dental Association, 1919, vi, No. 8, p. 1909.

The author's experience shows that seventy-two per cent of pulpless teeth have infections, the predominating organism being the streptococcus. In view of this high percentage of infections of pulpless teeth and the production of many grave systemic disturbances directly from such conditions, he believes that teeth which are even questionable should never be retained. The only proper course to pursue in such cases is the complete eradication of the infections by means of dental extraction and thorough removal of the infected bone. With special reference to the pathogenesis, the author's investigations indicate that the num-

ber of periapical infections resulting from the unnecessary operative destruction of periapical tissue is greater than is generally assumed. He doubts very much if the human hand can ever acquire the necessary skill to make perfect root fillings without producing grave injury to periapical tissue; neither can periapical infections ever be prevented by such means. While not condemning root amputations absolutely, he emphasizes his disappointment with the results obtained, and his avoidance of these procedures unless requested by the patient and then only with the understanding that it is likely to be a temporary success.

A Diagnostic Sign of Maxillary Constrictions of Reflex Origin. Roy. *La Restauration Maxillo-Faciale*, 1919, p. 2.

In the presence of traumatic constriction of the jaws of reflex origin, pressure exerted by a tongue-depressor on the base of the tongue, without necessarily exerting much pressure upon the lower jaw, causes a temporary disappearance of the constriction which permits the rendering of an easy and absolutely reliable diagnosis of the reflex origin of the contracture. Although this sign is not claimed to exist in all constrictions of reflex origin, the statement may be made that it never exists in constrictions of organic character, unless these are combined with a certain degree of reflex contracture. Consequently, the demonstration of this sign in patients suffering from contractions of the jaws may be considered as invariably pointing to the diagnosis of reflex constriction of the maxillæ of psychopathic origin.

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EDITORIALS

The National Dental Association and the Dental Corps

WE have before us the various dental journals for September which are sup-
posed to contain the program of the meeting of the National Dental As-
sociation which will be held in New Orleans in October. In looking over this
program one is impressed by the large number of subjects that have been
brought together in the various sections; which indicate that the officers of the
association have been trying to arrange a program that will be of importance
and of benefit to the dental profession. However, considering all the good
things that are present in this program, one can not help but observe the entire
absence of any recognition given to the dental corps as a whole. It is true that
we find the names of several men who have been prominent in dental services in
the army under various sections, but we find no department devoted to the

dental corps exclusively, neither do we find any recognition given to the men who gave up their profession and practices and responded to the call of their country.

In the 1918 meeting considerable recognition was given the dental corps. This was probably because at that time the United States was actively engaged in war, and also because some of the men prominent in the National Dental Association were also prominent in the army dental corps. We do not believe that just because the war is over, so far as actual fighting is concerned, the dental profession should forget the services that were rendered by men who did active duty either in this country or abroad. In fact, it seems to us that at the present time, the men in the dental corps should receive special recognition. They are now in a position to present to the dental profession information and facts that are much more valuable than anything that could have been contributed in 1918. From close association with some of the men who are at present in the dental corps, especially in the maxillo-faciale department, we are convinced that no branch of dentistry or group of men could show the dental profession so much of value and interest as could the men now active in the maxillo-faciale department.

The indifference which the National Dental Association has assumed towards the dental corps, especially the maxillo-faciale division, and the attitude which was held by the American Medical Association towards the same department at its meeting in June is exceedingly conspicuous. One of the most talked-of exhibits or departments of the American Medical Association meeting at Atlantic City was that of work done as shown by the men of the Walter Reed Hospital. The men now engaged in this work are doing so at a great sacrifice, and have not the glamour of a nation in actual warfare, or the beating of drums to urge them on, such as was customary in the 1918 meeting. They are making a professional sacrifice so far as private practice is concerned by rendering the country a service and doing work for the injured that certainly will not be forgotten by those who receive relief in the Walter Reed Hospital. However, the National Dental Association as a body did not think enough of their work or efforts to give them a place on the program or ask them to make an exhibit, according to the program published in the September issue of the *Journal*, or to give the dental corps any recognition as a body by devoting a part of the program to their work. It is true that there will be a meeting of the Association of Military and Dental Surgeons in New Orleans, but this meeting will be held as a separate organization and in no way be connected with the National Dental Association. Saying the least, some one has been negligent in not asking the dental corps to take part in the program, and an opportunity for the profession to gain valuable knowledge has not been taken advantage of.

Knowing as we do of the enormous amount of work that is being done by men in the dental corps at the present time, especially the maxillo-faciale division, we regret that their work can not be placed before the dental profession as a whole, as it should be, because of an oversight on the part of the management of the National Dental Association.

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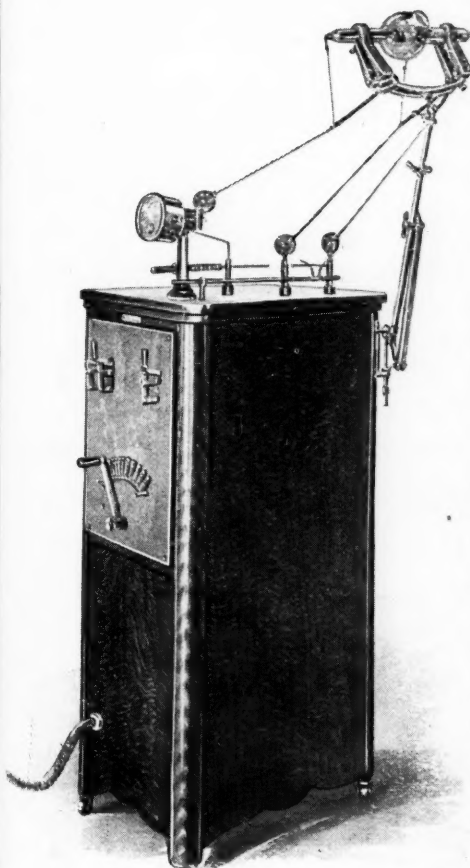
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